THE MODEL ENGINEER

IN THIS ISSUE

• TOOLS AND EQUIPMENT AT THE "M.E." EXHIBITION
COLOURING AND PLATING COPPER AND COPPER ALLOYS
• MAKING A MINIATURE VICE • READERS' LETTERS
SUPERCHARGED TWIN ENGINE FOR RACING HYDROPLANE

SEPTEMBER 23rd 1954
Vol. 111 No. 2783

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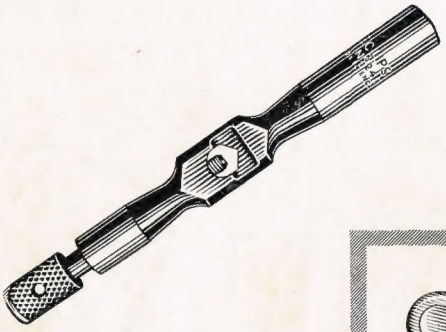

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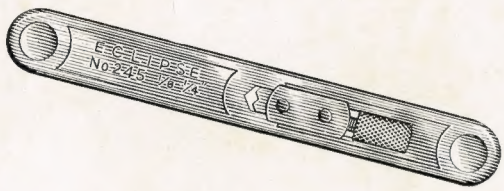

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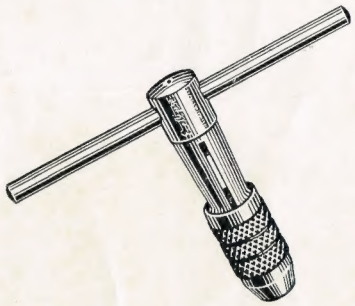

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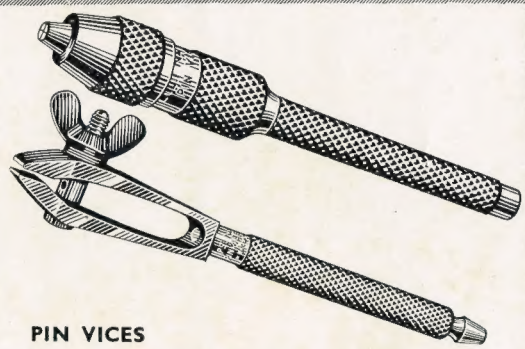

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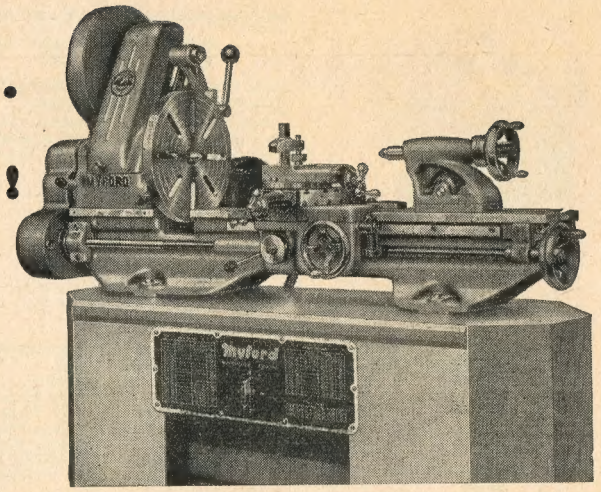

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Pitch dia., in.	.25	.37	.5	.62	.75	1	1.25	1.5	1.75
Price	1/2	1/2	1/7	2/-	2/3	2/11	3/6	4/8	5/7
No. of Teeth	80	90	100	110	120	130	140		150
Pitch dia., in.	2	2.25	2.5	2¾	3	3¼	3½		3¾
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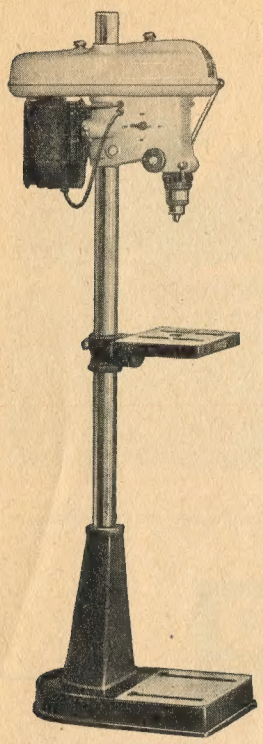

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Base	15″ x 9″	20″ x 14″
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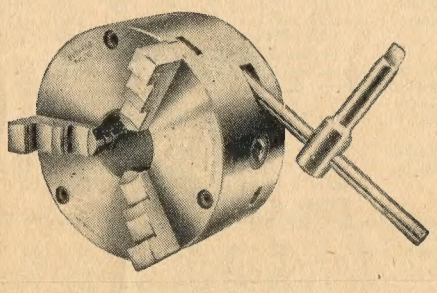

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3/16″ ...	2/3	3/3
7/32″ ...	2/3	3/3
1/4″ ...	2/3	3/3
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THE
MODEL ENGINEER

EVERY THURSDAY
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SEPTEMBER 23rd - 1954

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CONTENTS

SMOKE RINGS 353
QUOD ERAT DEMONSTRANDUM 354
MODEL POWER BOAT NEWS
The Bedford and Southampton Regattas 357
L.B.S.C.'s TITFIELD THUNDERBOLT
Injector and Hand Pump Clack 358
THE ALLCHIN "M.E." TRACTION ENGINE 361
A UNIVERSAL TOOL-GRINDING APPLIANCE 366
MAKING A MINIATURE VICE 367
THE 1900 LOCOMOBILE STEAM CAR IN 1954 369
COLOURING AND PLATING COPPER AND COPPER ALLOYS 370
TOOLS AND EQUIPMENT AT THE "M.E." EXHIBITION 374
A SUPERCHARGED VEE TWIN
An Experimental 15 c.c. Engine for a Racing Hydroplane 377
READERS' LETTERS 381
WITH THE CLUBS 382

OUR COVER PICTURE

Among the demonstrations of craftsmanship in many branches of model engineering at the "M.E." Exhibition, one of the most popular was that showing the construction of small boilers, mostly of the locomotive type, though marine and stationary boilers were also dealt with. The method of fabrication almost universally adopted nowadays is by brazing, and our photograph features Mr. Chas. Kennion, a well-known and highly skilled exponent of this art, working on a typical locomotive boiler. Many of our readers have expressed their appreciation of the practical demonstrations at the Exhibition, which are of great assistance to them in solving their own workshop problems. An article on the various amateur and trade demonstrations appears in this issue.

SMOKE RINGS

Chequer-plates

THE "M.E." Exhibition always gives a good opportunity for discussion among model engineers regarding details of models and the problems of producing them accurately. This year, we heard an interesting discussion among several exhibitors on the difficulties of producing correct scale chequer-plates for the footplates of marine engines, locomotives, etc. Most model engineers, in the attempt to reproduce these in a small scale, find that the nearest practical approach to this, produce an "intaglio" pattern by incising criss-cross lines with some form of cutting or engraving tool. In full-size practice, however, the lines are nearly always in relief, as this is the only way in which their main object, the avoidance of slipperiness, can be achieved. We know of several possible ways of producing a relief pattern, including etching, rolling, and stamping, but none of them can be considered really easy to carry out on a very small scale, and with limited equipment. No doubt many of our readers have tackled this problem in their own way and attained the desired results; if so we feel sure that practical information on this subject would be of interest to all readers who attempt to maintain accuracy and fidelity in their models.

Absentees

AMONG THE spate of correspondence on matters arising out of the "M.E." Exhibition, several comments have been made regarding the absence of certain well-known model engineering and equipment supply firms from the trade section. One reader has rather surprisingly deduced from this that the firms concerned were not invited to exhibit, or that certain conditions or aspects of policy on the part of the organisers has caused them to withdraw. We hasten to assure readers that all known members of trades associated with model engineering were duly invited to take part in the trade display at a date sufficiently early to enable them to negotiate all arrangements, including allocation of space, on a perfectly fair basis. Those who found it inconvenient to exhibit no doubt had their own good and sufficient reasons for declining, and we feel sure that they, at least, would not accuse us of unfair discrimination in this matter. However, our readers' letters do indicate that they definitely expect to see the familiar "M.E." advertisers at the Exhibition; if the very few absentees take this obvious hint, we shall be delighted to welcome them at future exhibitions.

The Fastest Stopping Train ?

THE SPEEDING up of some of the more important express trains on British Railways, introduced with this year's summer services, has created much interest and enthusiasm among the railway enthusiasts. Obviously, the 60, or more, miles per hour average speeds of such trains as the "Elizabethan," the "Bristolian" and the like, of course, attract the most attention and have built up a fine reputation among the members of the travelling public, with the result that the fame of these trains has spread afar.

There is, however, a much lesser train running, unnamed and, to all appearances, just an ordinary example of what is usually known as a "fast train"; that is, it calls at a number of stations on the way from one end to the other of its complete trip. The train referred to is the 7.50 p.m. from Paddington to Bristol, which calls at Reading, Chippenham and Bath. This train is timed to cover the 118½ miles to Bristol in 124 minutes, making the average speed, including the three stops, no less than 58.8 m.p.h. To keep time, this train has to leave Reading, 36 miles, at 8.25; Chippenham, 94 miles, at 9.25, and Bath, 106¾ miles, at 9.41. These must surely be among the fastest times ever booked for such a train in Britain, and they call for running that is at least equal to, if not better than, that of the non-stop "Bristolian." The train does not run on Saturdays.

The engine is a "Castle," manned by the same crew as on the up "Bristolian" the same day; the train is usually eight coaches, whereas the non-stop "Bristolian" has seven hauled by a "King" class locomotive.

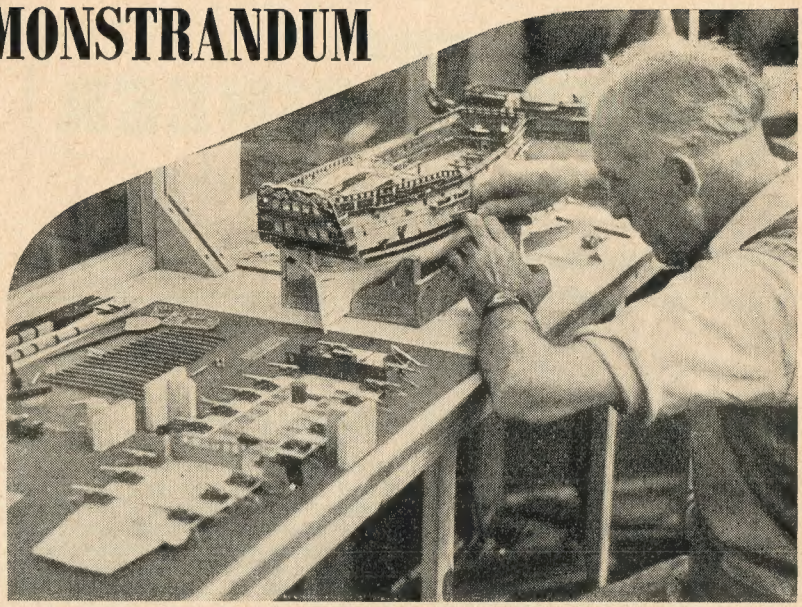
QUOD ERAT DEMONSTRANDUM

By J. Dewar McLintock

PERHAPS the best way to enjoy the demonstration area at the "Model Engineer" Exhibition would be to arrive early each morning, settle down on a shooting-stick opposite one of the demonstrators, and stay there for the day, with a packet of sandwiches. Even then there would hardly be enough days. . . .

There was an enchantment about this area. Keen modellers, serious-minded industrialists and business men, carefree kids, glamour girls, housewives—they would "stop for a minute" and stay half an hour or more. Mere models are infectious enough. Go near one and the bug attacks you and hangs on for a little, even if it doesn't get right into the system. But watch real top-notch models being made and the bug gets deep into the bloodstream!

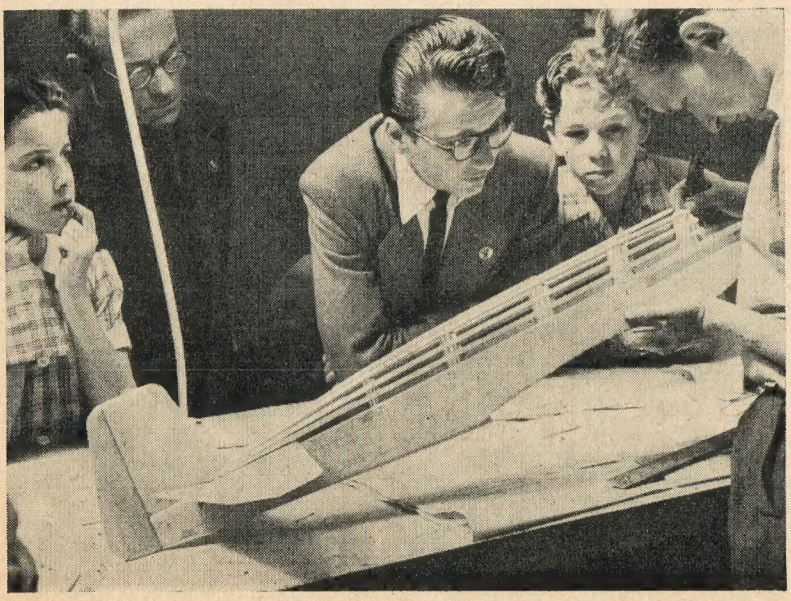
There was no need for these demonstrators to demonstrate. All they had to do was to get on with their hobby and answer questions. But what questions! This was where the silly question got a sensible answer, but the sensible question probably meant twenty minutes earnest technical discussion. Only very special kinds of patience, courtesy, and intellect would do for this form of demonstration, and Brigadier Richards—himself a rare example of the benevolent disciplinarian—is to be congratulated on his team and on the organisation of their activities.



Mr. R. J. Collins—lost in a world all his own—brings the craftsman's skill to bear on a beautiful model of a fighting ship

I hit on something that expresses one aspect of the calm, detached, yet fanatical quality of these activities. Mr. R. J. Collins, talking of his special interest in 18th century ships, said: "I get lost in this. I can forget all the everyday cares—even income tax . . . !"

I asked him how he came to take an interest in his subject. "It all started when I was in civil defence," he answered, rather surprisingly. "We often had time on our hands. I started on galleons, with any old pieces of timber—and there were plenty about! When I think of some of my first efforts, I'm ashamed. They were dreadful things. But now I believe I can claim to be an authority on the historic side of the business, as well as being a *real* model-maker." His models certainly show a wonderful perfection, even to the tiny deck-gratings (for which he uses a jig of his own devising); the brass cannons (turned on a Super Adept lathe), and even the "heads" or historic latrines. Mr. Collins told me that he is an entomologist. In naval history and its interpretation, he finds a relaxation from natural history. This was his fifth year on the demonstration area.



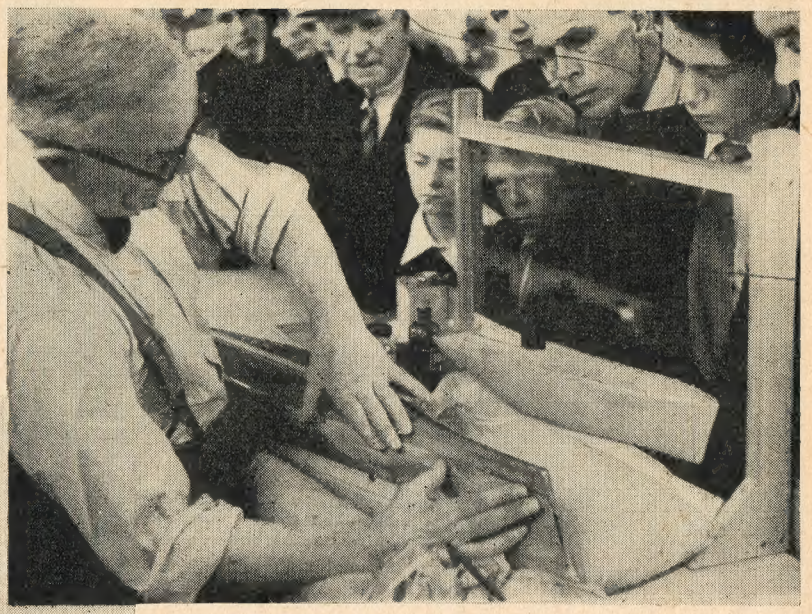
The bold approach to model aircraft design and construction, as exemplified by Mr. D. Bishop in creating a new control-line flier

Across the way, Mr. D. Bishop was doing some deft model aircraft work, the balsa taking accurate and beautiful shape under his Exacto knife. In the course of the Exhibition he completed three models—a free-lance control-line stunt job, a Skylark model in the same category, and a 5-ft. span special control-line flier with 10 c.c. glow-plug motor. "Do you belong to a club?" I asked. "Oh yes, I'm a member of the Bushy Park Club—one of the oldest. We fly on Hounslow Heath, these days. We get a lot of fun out of these models, and I'm experimenting with glass-fibre at the moment."

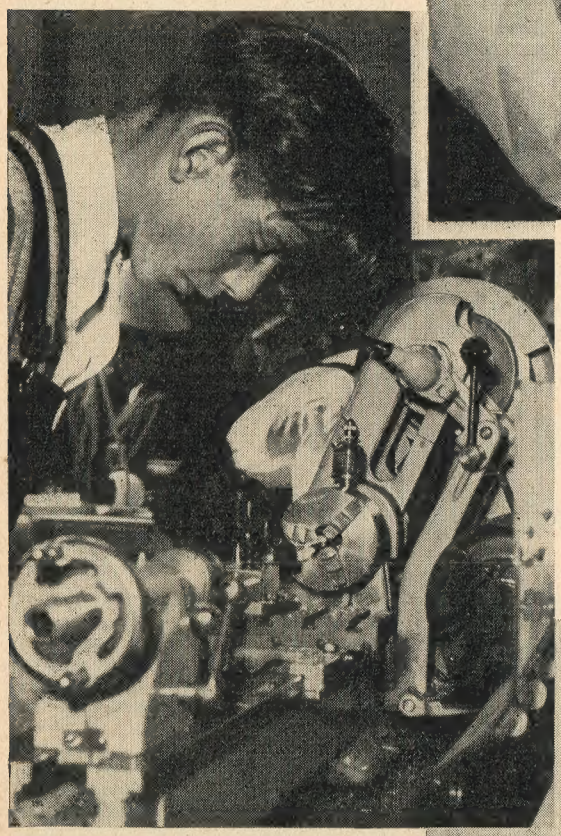
Glass-fibre . . . that reminded me that I wanted to see and chat with Mr. Critchett Chapman, who was demonstrating model boat hull construction. Had he made a feature of glass-fibre? Apparently not, owing to some difficulty with supplies, but he *was* showing a hull made from linen and polyester resin, and this struck me as being a fairly effective substitute—cheaper, but not quite so strong, perhaps. Meanwhile, enthusiasts were engrossed

in his method of making plated hulls in strips of thin tinplate. He gets the double curvature by swageing the strips under the pressure of a hardwood former—a suitable tool-handle would do. Strips are held by drawing pins on to a solid bread-and-butter hull (made in blocks so that it can be dismantled when the skin is made) and are soldered with a minute overlap. He was working on a model of the Royal Yacht *Britannia*, the scale of which is determined by the measurements of the boot of his car ! It will be electric-powered and the tinplate hull will give a realistic waterline.

I switched to " heavy engineering "



A scale model of the Royal Yacht " Britannia " takes shape in tinplate, under the skilled hands of Mr. Critchett Chapman. Beside it is a linen-and-polyester resin hull



Left and Below—Some of Mr. Aimer's capable lads, seen working on assignments which are interesting as well as instructive. They are pupils of Cuckoo Hall Secondary Modern School, and this is part of their normal training

in the form of the demonstration of soldering, brazing and boilermaking, by the skilled Kennion, Turpin, and Brig. Richards team. I arrived in time to see a convincing demonstration of silver-soldering, with Incanto oxy-acetylene welding equipment. I believe a certain pundit has laid down that this is a form of model engineering hari-kari, but the Brigadier said: " It can hardly matter whether you use coal gas or acetylene. The thing is, the *heat* must make the solder run, and the secret is to get the job up to the correct heat first." He agreed that oxy-acetylene might be a little tricky for a beginner, but it was clear to me that

Mr. H. W. Beasley makes planked hull construction look deceptively easy, and few can resist a closer inspection

there were no beginners among this team. . . . I dared to accuse the Brigadier of being a R.E.M.E. man, and escaped lightly because he is a tolerant man. He is, of course, a gunner, and is a model engineer for the fun of it.

Still in a boilermaking frame of mind, I moved to the opposite corner, where Mr. J. R. Aimer and his pupils of the Cuckoo Hall Secondary Modern School were making the boiler for *Butch*, the husky little locomotive which they started earlier in the year. Three of his six boys were on this project, beating, drilling, countersinking and riveting, and generally persuading the 14-gauge copper into the shape of things to come. Three others were working on a $\frac{1}{4}$-in. capacity bench drill. I felt a certain sympathy with the lad whose mission was to file up the baseplate dead true. A case of engineer's blues, perhaps ? Mr. Aimer himself—an enthusiast if ever there was—seemed to be here, there and everywhere, giving guidance and practical advice. I was interested to learn that Mr. Aimer's groups were working on Kennion castings, for both projects.

Back again to ship models—with Mr. G. H. Draper holding his audience with a very interesting account of how he makes his beautiful miniatures of naval boats of all periods, as well as *his* particular method of making those inevitable little gratings. Now, Mr. Draper is a good subject for a chronicler like me. He likes to talk; so I let him talk, and very interesting it was, too. He has been a modeller as long as he can remember, and he tried most subjects before he settled for boat and ship modelling, of which he is now such a master as to be able to meet the exacting requirements of museum curators.

"What timbers do you use ?" I asked. "Mostly lime and apple," he answered. I scented romance here, and was delighted when he added: "Timbers from my own county of Essex, too, mark you. . . ." It appears that he has not much use for imported stuff. Lime is coveted by builders of ship models, but is scarce and relatively expensive. He gets his timber from his friend Mr. McGrath—a director of the Chetham Timber Co. Ltd., 229, High Street, Stratford, E.15. The apple is for his $\frac{1}{16}$-in. scantlings. It is suitably pliable, homogeneous, free from spongy bits. Mr. Draper makes his boats in three main sections—two sides and a centre section. The sections are roughly hand-carved, then beautifully finished with rotary files. Particular attention is paid to grain-direction, the timber rings corresponding approximately to the hull's cross-section. Mr. Draper makes his own hand-tools—an added joy and recreation—and uses Reeves paints for the priming, undercoating and finishing. Usually, he is working on two or three boats at a time, so that paint-drying does not interrupt the joyous process. Incidentally, he is a keen angler.

Keeping within the sacred precincts of the model ship field, I observed the virtuosity of Mr. J. T. Brittain, who was demonstrating sail-making, and that of Mr. H. W. Beasley, who made planked hull-construction look deceptively easy, then I broke free from this strangely compelling microcosm of industry and wandered down again to look at the competition models with a new and terrible critical faculty.

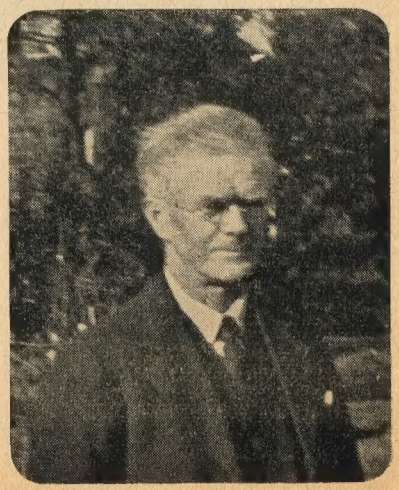
Who's Who IN MODEL ENGINEERING

DAVID McCLURE YUILE

Craftsmanship in all its forms, and lathe work in particular, has been the lifelong passion of Mr. Yuile, who was born in Manchester in 1875, and can claim over 70 years' practical interest in model engineering. He was apprenticed to Messrs. Robert Harvey & Co., Kinning Park, Glasgow, and has since followed the profession of general engineer and designer of ordnance.

In the latter capacity, he made a working model of an 18-pounder field gun of his own design, which was adopted by the British Army. Clock making and ornamental turning, including design and construction of all tools and accessories for this work, are among his activities, together with boat building, sailing, racing and cruising. He has built two full-sized yachts, in Glasgow and London respectively—both constructed in his bedroom.

Of his later activities, the design of surgical appliances for the aid of the limbless, such as improved crutches, mechanical hands, &c., has occupied much of his time, and he is a keen demonstrator and instructor in passing on the results of his own long experience, including the use of his improved lathe, which is fitted with unique attachments, enabling components of any shape to be machined. Formerly a member of the London S.M.E.E., he is now a life member of the Glasgow S.M.E., and a Silver Medallist in Ornamental Turning.



Model Power Boat News

BY MERIDIAN

THE BEDFORD AND SOUTHAMPTON REGATTAS

THE annual regatta of the Bedford M.E.S. was held this year at Wicksteed Park, Kettering, and this naturally reduced the attendance, owing to the increased travelling distance for Southern competitors. I hear, however, that the home water of the Bedford Club is to be cleared of weed by the local authorities, and it is hoped that next year's event will be able to be held at Longholme.

The straight running events were most affected by the change of venue, but the hydroplane entries were quite

A Southampton competitor, Mr. E. J. Rawlings, with "Vigilante," winner of the Nomination race

Mr. E. A. Calloway (Southampton) with his model M.T.B.

numerous. Here are the results:

50 *yard Nomination Race*
(1) C. Townsend (Victoria), *Jean*: error 0.2 sec.
(2) H. Wriath (Altrincham), error 2.9 sec.

Steering Competition
(1) C. Townsend (Victoria), *Jean*: 10 points.
(2) H. Wriath (Altrincham): 5 points.

500 *yard "C" Restricted Race*
(1) W. Everitt (Victoria), *Nan*: 60.89 m.p.h.
(2) K. Hyder (St. Albans), *Slipper* 4: 56.2 m.p.h.
(3) C. Stanworth (Bournville), *Whiz*: 49.41 m.p.h.

500 *yard Class "C" Race*
(1) R. Phillips (St. Albans), *Foz* 2: 59.47 m.p.h.
(2) C. G. Stanworth (Bournville), *Coco*: 41.35 m.p.h.
(3) E. Woodley (Victoria), *Kathleen* 2: 39.96 m.p.h.

500 *yard Class "B" Race*
(1) W. Churcher (Coventry), *Annette* 3; 54.4 m.p.h.
(2) G. Lines (Orpington), *Genevieve*: 51.32 m.p.h.
(3) A. Cockman (Victoria), *Ifit* 9: 40.43 m.p.h.

500 *yard Class "A" Race*
(1) W. Brightwell (Wicksteed), *W*14: 62.38 m.p.h.

(*Continued on page* 360)

L.B.S.C.'s Titfield Thunderbolt

INJECTOR AND HAND PUMP CLACK

WHILST the injector for the *Tits* follows my general practice for this type of boiler-feeder, there are two or three small differences in detail, which are shown on the accompanying drawings. The business end of the steam cone is very short, and has a double-reverse taper which is a replica of the very short steam cone on the Swindon-made injectors now used as standard on British Railways locomotives. As most followers of these notes know well, what Swindon does, "goes" with your humble servant; and when I tried the weeny Swindon cones in the injector of one of my own engines, I found that I could use a drill two sizes smaller, for the throat of the steam cone, without sacrificing any efficiency, but of course using less steam. No union will be needed for the water pipe, this being silver-soldered direct to the injector body, entering at the side of same, as the injector is located crosswise under the footplate. Absence of a water union at the bottom, allows a small boss to be silver-soldered to the body, which is tapped for the overflow pipe, and gives a better hold than if the pipe were screwed direct into the body. As I have already given very full detailed instructions on how to make injectors, in previous notes, a brief résumé of the operations should suffice in the present instance; I should imagine that the drawings are clear enough for any tyro to understand, as my great endeavour is to avoid complication. Anyway, here goes.

Body and Air Release Valve

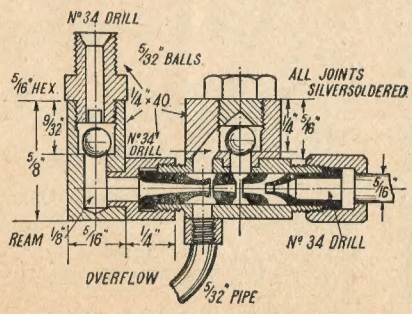
Saw or part off a piece of $\frac{5}{16}$ in. square rod a full $\frac{7}{8}$ in. long—brass will do, as there is no movement and consequently no wear—chuck truly in the four-jaw, face, centre, drill through with No. 23 drill, and ream 5/32 in. Turn down 5/32 in. length to $\frac{1}{4}$ in. diameter, and screw $\frac{1}{4}$ in. × 40. Reverse in chuck, and repeat turning and screwing, on the other end. On one of the facets, set out and drill the holes as shown in the view of the body marked "top"; form the counterbore with a $\frac{3}{16}$-in. pin-drill having a $\frac{1}{8}$-in. pilot, and make it $\frac{1}{16}$ in. deep. On the next facet, marked "side," drill a No. 23 hole for the water-pipe. At the bottom, drill a No. 30 hole at the location of the boss, indicated by the centre of the two circles. Chuck a bit of $\frac{1}{4}$-in. rod and turn down about $\frac{3}{16}$ in. of it to 7/32 in. diameter; face the end, and make a deep countersink in it. Part off at a full $\frac{3}{16}$ in., from the faced end, reverse in chuck, and turn a pip on the end, a bare $\frac{1}{16}$ in. long, to a tight fit in the No. 30 hole. Squeeze it in.

The Ball Chamber

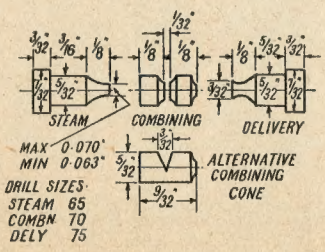
For this item, part off a piece of $\frac{1}{2}$-in. round rod $\frac{3}{8}$ in. long. Make a centre-pop on one end at $\frac{1}{16}$ in. off centre, chuck in four-jaw with this running truly, and drill right through with No. 34 drill. Open out and bottom to $\frac{1}{4}$ in. depth with 7/32-in. drill and D-bit, and tap $\frac{1}{4}$ in. × 40. Rechuck the other way around, on a stub mandrel held in three-jaw, and turn a $\frac{1}{16}$-in. pip on the end, to a tight fit in the counter-bore on the injector body. Run a $\frac{1}{8}$-in. parallel reamer through the remains of the No. 34 hole; then, at $\frac{3}{16}$ in. from the centre of the hole, run a No. 34 drill in, on the slant (see section) but be careful to avoid damaging the ball seating. The pip on the ball-chamber can then be pressed into the counterbore on the injector body, taking care that the diagonal hole registers with the corresponding hole in the injector body; a piece of 5/32-in. copper tube a full $1\frac{1}{2}$ in. long, is fitted into the side hole, and the whole lot silver-soldered at one heating. Pickle, wash off, clean up, and fit the ball and cap as shown, making the cap from $\frac{5}{16}$-in. hexagon rod, and giving the ball a bare $\frac{1}{16}$ in. lift. Run the 5/32-in. reamer through the bore again, in case the drills have left any burrs. I nearly forgot to mention that the overflow boss should be drilled through with No. 30 drill, and tapped 5/32 in. × 40 for the pipe, after the silver-soldering job.

Cone Reamers

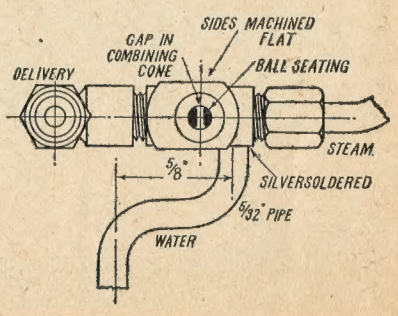
As the steam cone is a little different from those I have hitherto specified, a special reamer, with a thin shank for running inside the drilled part of the cone, will be needed for this part of the job. This is shown along with the regular reamers, and can be made from 7/64-in. silver-steel, or a bit of larger diameter can be turned down to the required size. The tapered part is $\frac{5}{16}$ in. long. Turning the tapers is, as I have remarked before, a simple trial-and-error job. I've never had any trouble in turning them, using a sharp pointed tool slightly rounded off at the end (says Pat) plus a drop of cutting oil. The Myford "supersonic" does this fine in top gear! When hardening and tempering, if you dip the hot reamers vertically, and not too quickly, into the cooling water, the points won't distort. A good tip is to use an old can for the quenching job, fill it nearly full with cold water, and put a thin layer of sperm oil on top of the water. A red-hot reamer plunged



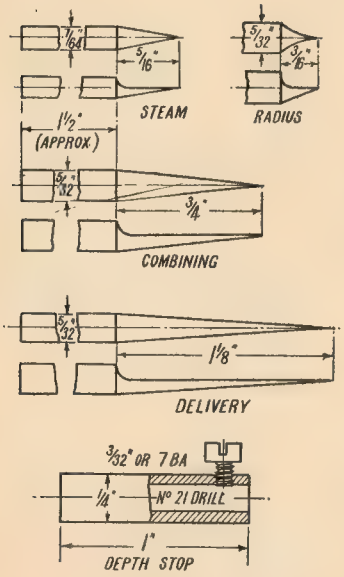
Section of injector



Details of cones



Plan of injector



Cone reamers and stop

vertically into the mixture, will harden and temper at the one shot.

Several readers have told me that they turn the tapers, then do the hardening and tempering act, and grind away half the taper as the last operation, completely obviating any risk of distortion. That's O.K. as long as you don't let the thin ends of the tapers get too hot while grinding; if you do, you've had it.

The depth stop is just a 1-in. length of round rod, drilled No. 21 and furnished with a set-screw. Placed on the reamer shank at the right distance from the point, it prevents the reamer being entered far enough to enlarge the hole drilled in the throat of the cone, the size of which is vital to correct operation.

Cones

Making the cones is the *pons asinorum* of the beginner, and is a job dreaded by many experienced workers. Well, I hope no builders of the *Tit* engines become scared, because the "difficulty" has been grossly exaggerated, like other operations in locomotive-building. Anybody who makes them in the same way as I do, should have no trouble; and my method is as follows. The combining cone is made first; and as this must be a press fit, the steam end of the injector is slightly broached with an ordinary taper broach fitted in a handle. A bit of $\frac{3}{16}$-in. rod is then chucked, and turned down for $\frac{3}{8}$ in. length until it just fits tightly into the broached end of the injector body. The end is faced, centred with an arrow-head centring-drill made from a broken-off dental burr, and drilled for $\frac{5}{16}$ in. depth with No. 71 drill. I use my lever tailstock when doing the job on my Boley lathe, and work it like a pump handle, only letting the drill penetrate $\frac{1}{16}$ in. or less, at each stroke; and the drill doesn't break, the flutes keeping clear. The end of the rod is turned to a very blunt nose around the hole, and the piece parted off at a bare $\frac{5}{16}$ in. from the end.

The blank is re-chucked nose first, with a full $\frac{1}{8}$ in. projecting from the jaws, and the reamer with $\frac{1}{4}$-in. taper fed into it with the tailstock, the depth stop being adjusted so that the point of the reamer will just show through when the stop "hits." The stubby radiusing reamer is then put in the tailstock chuck, and the end of the taper hole radiused as shown in the section. The blank is then sawn across flush with the chuck jaws, using a jewellers' hacksaw. The bit remaining in the jaws, is pulled out a little way, the end faced off as shown in the illustrations, and the hole slightly radiused. The other bit is chucked with the sawn side out, and the end faced and cut back.

The nose end is then entered into the broached end of the injector body, and pressed in until it just passes the centre of the hole at the bottom of the ball chamber. I use a bush press, but the bench vice does just as well, a bit of 5/32-in. brass rod being used as a pusher. A sliver of brass 1/32 in. thick, is then poked down the hole, and the second half of the cone pressed in until it touches the sliver. The taper cone reamer is then entered into the pressed-in cone, and turned with finger and thumb, until a No. 70 drill can just be poked through the cone, when held in a pin chuck and turned in similar manner. What "difficulty" there is in carrying out the above, couldn't be detected with a 16-in. telescope, to my way of thinking !

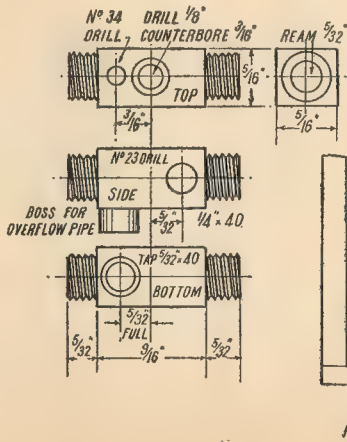
Same applies to the other cones. For the delivery cone, turn down a piece of $\frac{1}{4}$-in. brass rod to a tight fit in the bore, and just long enough to touch the nose of the combining cone when entered. Turn the next $\frac{1}{8}$ in. or so to 7/32 in. diameter. Centre, and drill to $\frac{7}{16}$ in. depth with No. 76 drill, operated as above. Take a 1/64-in. skim off the end, and turn the outside to shape shown, belling the end with the stubby reamer. Part off at a full 3/32 in. from shoulder, reverse in chuck, and ream with the $1\frac{1}{8}$-in. taper reamer, radiusing the end and facing off truly. The stop should be set so that the point of the reamer just shows through the bell. Then shift the stop back, and feed the reamer by hand, until you can just poke a 75 drill through, holding in a pin chuck and twisting with your fingers.

The Steam Cone

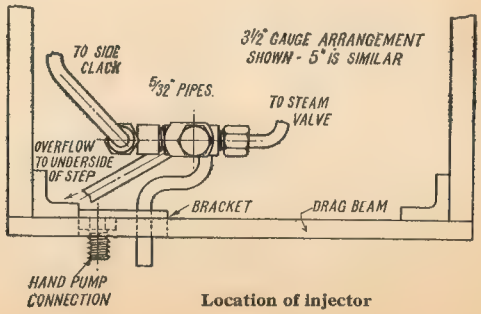
To make the steam cone, chuck the rod again, and face the end; then turn down to a tight fit in the bore, a length of $\frac{5}{16}$ in. Check this by pushing the body on to the turned part; when the end touches the combining cone, the shoulder should be 1/32 in. away from the body. Use a bit of metal for a gauge; I made mine from a broken bit of a 22-gauge hacksaw blade. Turn the next $\frac{1}{8}$ in. to 7/32 in. diameter, and then centre, and drill to $\frac{7}{16}$ in. depth with No. 67 drill. Turn the outside to shape shown, making the outside diameter of the nozzle between 0.063 in. and 0.070 in. If you haven't a "mike," just drill a No. 51 hole in a bit of sheet metal, and use that for a gauge; the tip of the nozzle should just enter. Ream the end with the $\frac{5}{16}$-in. taper reamer, until almost to a knife edge; part off at 3/32 in. from the shoulder. Reverse in chuck, drill to a bare $\frac{9}{16}$ in. depth with No. 34 drill, then carefully ream until you can just get a No. 65 drill through. Face the end, and the cones can be inserted as shown. Fearful job, isn't it—enough to turn a brunette into a platinum-blonde !

Check Valve and Erection

There is no need to detail the check-valve or clackbox, as it is made from a $\frac{5}{8}$-in. length of $\frac{5}{16}$-in. rod, machined just the same as the top of the feed pump and the boiler clacks. The socket at the bottom is made from $\frac{5}{16}$-in. rod. Chuck, face, centre, drill about $\frac{3}{8}$ in. depth with No. 34 drill, open out and bottom to about 7/32 in. depth with 7/32-in. drill and D-bit, tap $\frac{1}{4}$ in. × 40, part off at a full $\frac{5}{16}$ in. from the end, reverse in chuck, and turn down $\frac{1}{16}$ in.

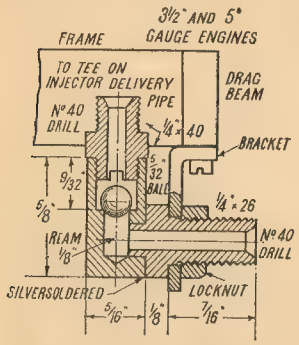


How to drill injector body



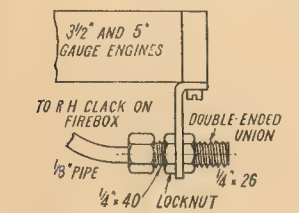
Location of injector

to a tight fit in a $\frac{3}{16}$-in. hole drilled near the bottom of the clack body, as shown in the section. Silver-solder the joint. When the clackbox is screwed on to the end of the injector, it should stand vertical; if it doesn't, take a skim off the flange of the delivery cone, until it stands upright when screwed on tightly.



Alternative hand-pump clack

The location of the injector on the locomotive, is shown in the plan, and is the same for both sizes. The water-pipe is bent to the shape shown, and pushed through the inner hole in the pipe bracket under the drag beam. Hold the injector in position, and measure with bits of wire, from the top of clack to the one on the firebox side, and from the steam end of the injector, to the steam valve on the boiler. Connect with lengths of 5/32-in. pipes, furnished with union nuts and cones, as previously described. Note, the end of the steam pipe which is attached to the injector, has a flat collar instead of a



Direct hand-pump connection

union cone. The overflow pipe can be left until the steps are fitted, as the outlet end can be attached to the underside of the stirrup by a clip, and is easily visible from the driving car.

Hand-pump Connections

If side clacks are used to take the delivery from the crosshead pump, only a plain double-ended union will be needed for the tender connection bringing water from the emergency hand-pump. This is shown in the illustration, and consists of a double union screwed $\frac{1}{4}$ in. × 26 at one end, and $\frac{1}{4}$ in. × 40 at the other, with a $\frac{1}{8}$ in. of hexagon left in between. The latter end is put through the hole in the left-hand bracket and secured by a locknut; connection is made by a $\frac{1}{8}$-in. pipe furnished with union nuts and cones, to the right-hand firebox clack, as shown.

Auxiliary Clack

If no side clacks are fitted, and the injector and hand-pump feeds both lead to the left-hand firebox clack, as shown in the diagram of alternative connections in the last instalment, an auxiliary clack will be needed to prevent the injector feeding back to the tender. This is shown in section, and is made in the same way as the injector clack, the only difference being, that a long $\frac{1}{4}$-in. × 26 union nipple, with a locknut, takes the place of the socket. Details, and mode of erection, are clearly shown in the illustration.

If the auxiliary oil check valve is used it only has to be fitted by the side of the lubricator, in place of the plain pipe, the lower end being connected by a pipe with unions, to the check valve under the lubricator. The upper end is connected by pipe and unions, to the steam pipe in the smokebox, same as the plain pipe. The boiler can then be permanently erected and I'll give some tips on that, in the next instalment, all being well.

MODEL POWER BOAT NEWS

(*Continued from page* 357)

(2) G. Lines (Orpington), *Big Sparky*: 51.01 m.p.h.
(3) W. Everitt (Victoria), *Melody*: 50.4 m.p.h.

Southampton Regatta

A very full programme was planned for this regatta, and a large attendance resulted. Interruptions in the form of rain caused some dislocation of the sequence of events, and the radio control event had to be run at the far end of the lake, simultaneously with the circular-course racing. This arrangement gets the event over, but is not so good for spectators, who may like to see both types of boat in action.

A magnificent array of prototype and straight running boats contested the Nomination and Steering events, and the home club was successful in winning the former. Mr. Rawlings' fine river steamer *Vigilante* was only 0.8 sec. in error. First place in the Steering competition went to Cheltenham: Mr. Burgess scored 13 points with *Lady Maud*, 2 points ahead of Mr. Downing of the Portsmouth Club.

One of the best performances in the speed events was the winning of the Class "A" race by B. Pilliner's flash steamer *Eega Beeva* at a speed of 59 m.p.h. This is the best run by a flash-steam boat for some time, and it was a wonderful spectacle.

The 1,000 yard race was run concurrently with the 500, enough time-keepers being available to allow the boats to continue the course after the first 500 yards had been completed. The winner of this race, which was open to all classes, was K. Hyder (S. Albans), with *Slipper* 4. The speed for the 1,000 yards was 61 m.p.h.

Results

Nomination Race
(1) Mr. Rawlings (Southampton), *Vigilante*: error 1.7 per cent.
(2) Mr. Cousins (Welling), *WG6*: error 2.1 per cent.
(3) J. Cleary (Blackheath), *Patricia*: error 2.6 per cent.

Steering Competition
(1) Mr. Burgess (Cheltenham), *Lady Maud*: 13 points.
(2) Mr. Downing (Portsmouth), *PM 15*: 11 points.
(3) Mr. Vosper (Southampton), *SH 12*: 10 points.

Radio Control
(1) Col. Taplin (Birchington).

500 *yard Class "D" Race*
(1) K. Turner (Bournemouth): 27 m.p.h.

500 *yard Class "C" Restricted Race*
(1) K. Hyder (St. Albans), *Slipper* 4: 56.82 m.p.h.
(2) F. Boby (Portsmouth), *BO*: 20.5 m.p.h.

500 *yard Class "C" Race*
(1) R. Phillips (St. Albans), *Foz 2*: 53.82 m.p.h.
(2) B. Miles (S. London): 51.04 m.p.h.

500 *yard Class "B" Race*
(1) J. Bamford (Aldershot), *Jab II* 47.56 m.p.h.
(2) A. Cockman (Victoria), *Ifit* 9: 32.3 m.p.h.

500 *yard Class "A" Race*
(1) B. Pilliner (Southampton): 59 m.p.h.
(2) N. Hodges (Orpington): 55.6 m.p.h.

THE ALICHIN "M.E." TRACTION ENGINE

to 1½ in. Scale

By W. J. Hughes

IN the prototype engine, the front axle is a forging, turned down at the ends to form the journals, and swelled out in the centre to allow for the swivel-pin. It is carried in a fork which rotates in a turn-table bolted to the perch-bracket, which in turn is riveted to the smokebox. The fork and the turn-table are both steel castings, and the perch-bracket is bent up from sheet steel.

Two lugs, designated *A* in photographs No. 71 and 72, are cast on the fork, their purpose being to prevent overlock of the steerage. When the axle is at full-lock, one or other of the lugs bears against the push-pole lug, which is cast in one with the turn-table and projects downwards. The push-pole lug, by the way, was to allow the attachment of a pole by which the threshing-machine or other apparatus could be shunted into position in the stack-yard. It should, therefore, carry a pin similar to that fitted to the draw-bar.

The apertures at the front and back of the perch-bracket are closed by thin plates, the rear one fastened with screws, and the front one by pins and cotters. In the photograph the plate has slipped off the pins, but the cotters may be seen dangling on their chain from the smokebox door. Two lamp-brackets are also bolted to the perch-bracket.

The steerage-chains are attached to two brackets bolted to the spud-pan and are supported by an angle-ring which also serves to reinforce the pan. Two short lengths of angle are fitted inverted at the sides to prevent the chain from riding-up over the top edge of the pan.

Front Axle

For the front axle of our model, friend Reeves supplies a neat casting in malleable iron, though anyone who has a suitable slab of steel available could cut it from the solid. In this case, the collars could be brazed on as in Stan Green's B.6 Fowler. (See THE MODEL ENGINEER, dated April 2nd, 1953.)

With the casting, clean it up with a file, mark the centres of the ends, and centre-pop them. (If you have a bell centre-punch, that saves the trouble of marking, and if not, one is well worth the making for centring axles and shafts.) Centre-drill the ends, and mount the axle between centres, with driver-plate on the mandrel nose and carrier on the axle.

You can now rough-turn one end, reverse in the lathe, and rough-turn the other, including the collars, and "miking," both journals to the *same* diameter, say 10- or 15-thou. oversize.

Remove from the lathe, and set the journals in two vee-blocks resting on the surface-plate, lathe-bed, drilling-machine table, slab of plate-glass, or what-have-you. (My "surface-plate" is a piece of ¼-in. *plate*-glass, bought second-hand at the local glaziers for a couple of bob.)

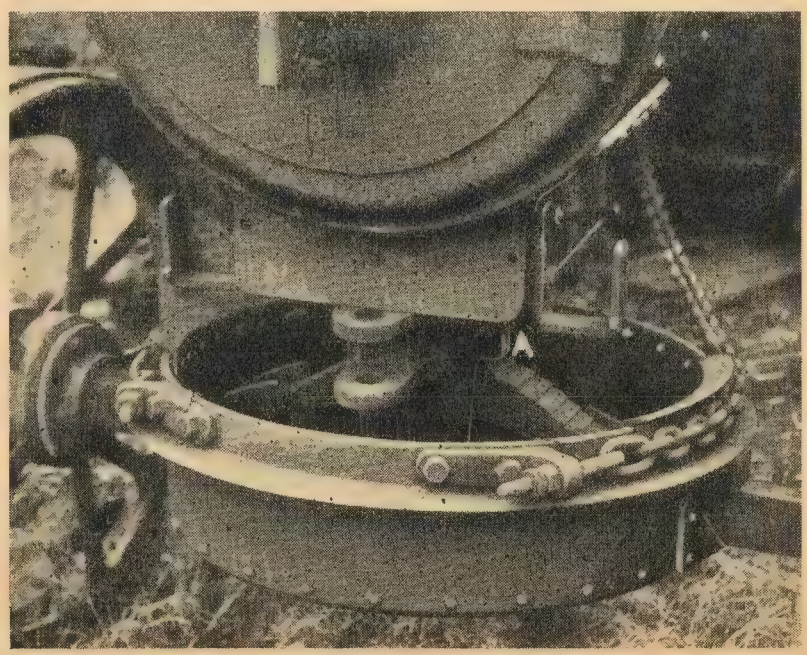
Set the surface-gauge to centre-height, and scribe a line on the top and bottom of the axle. Then successively set the gauge $\frac{3}{16}$ in. above and below centre, scribing parallel lines at these heights above and below-centre. A smear of marking blue or copper sulphate applied beforehand will help the lines to show, and they may be centre-dotted also. The axle should be clipped to one of the blocks during the scribing of course.

To remove the waste I used one of my favourite weapons; a 14-in. file of about ¾ in. square section, with coarse teeth that really *shift* the metal. It was bought years ago with several other big files—all "seconds"—from a stall in the local market, averaging about sixpence apiece. The radii leading into the collars were cleaned out with a 6 in. round file, and the flat surfaces finished off with an 8-in. flat file to the centre-dotted lines.

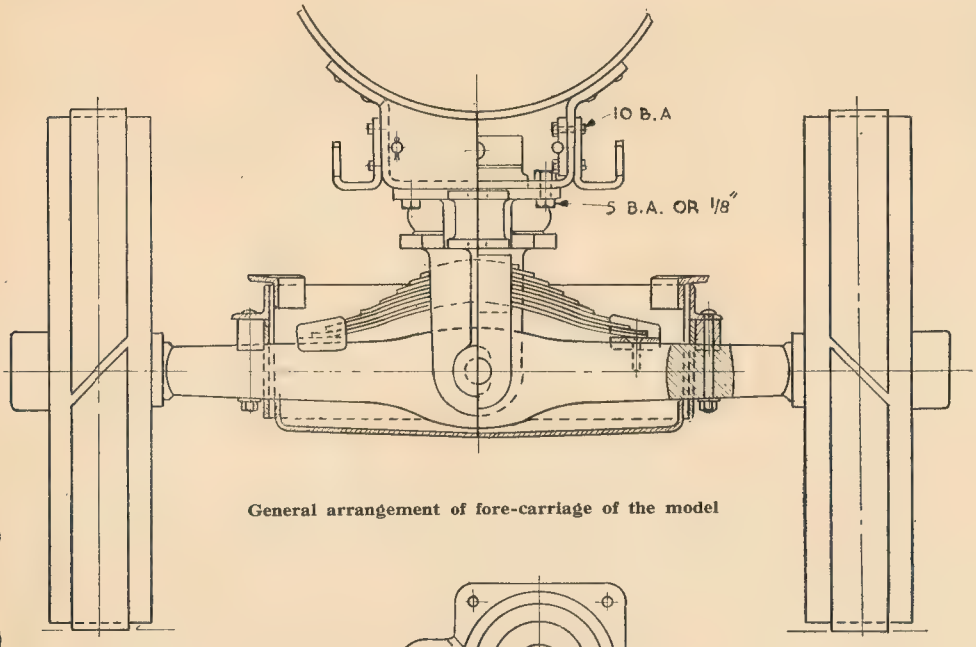
The top and bottom edges of the axle were set out next, and filed to shape. To make the central slot in the axle, mark the horizontal and vertical centre-lines, and centre-pop at ⅛ in. above and below the intersection. Drill ⅛-in. holes at both points, and follow through with the ¼-in. drill. Join the holes with a small round file, and finish the sides of the slot with a smooth file until a ¼-in. rod will slide smoothly but without shake in the slot. Alternatively, the slot can be end-milled out, of course.

The axle may now be mounted

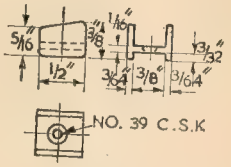
Continued from page 254, *August* 26, 1954.



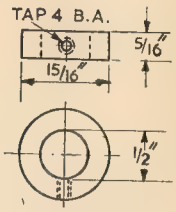
Photograph No. 71. Front view of the fore-carriage of "Royal Chester"



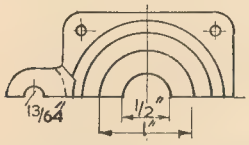
General arrangement of fore-carriage of the model

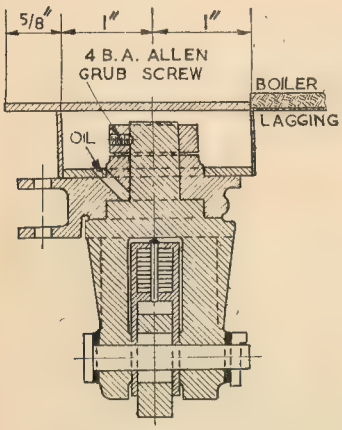


Rubbing-plates : two required

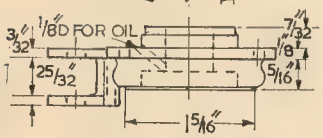


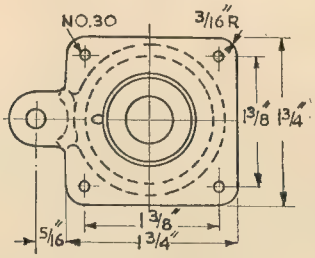
Collar for fork



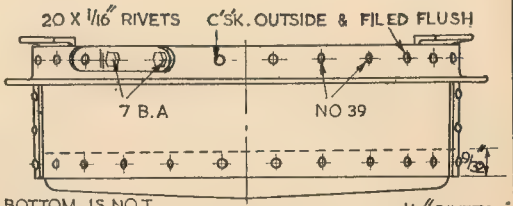


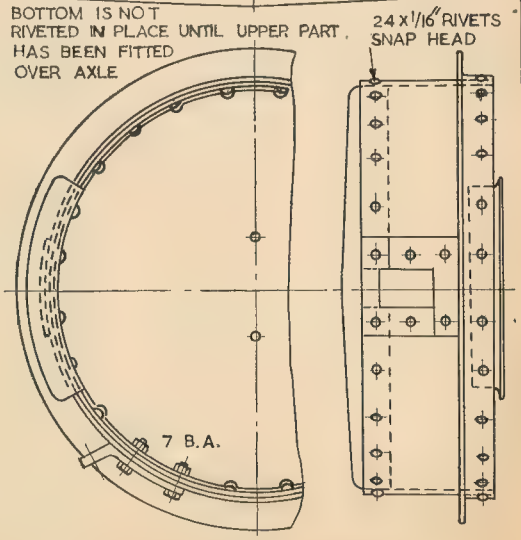
Cross-section of fore-carriage to show assembly



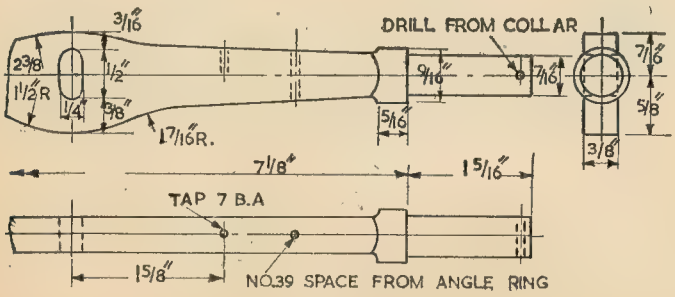


Turntable and push-pole lug

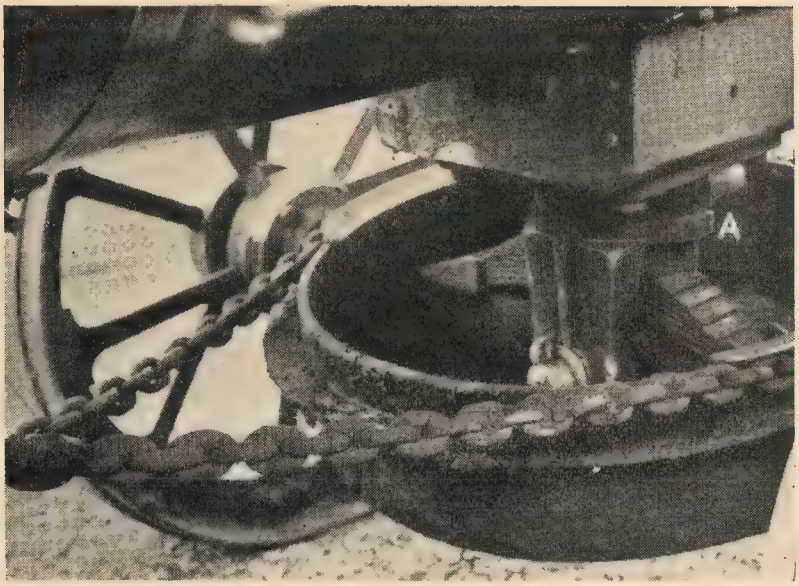




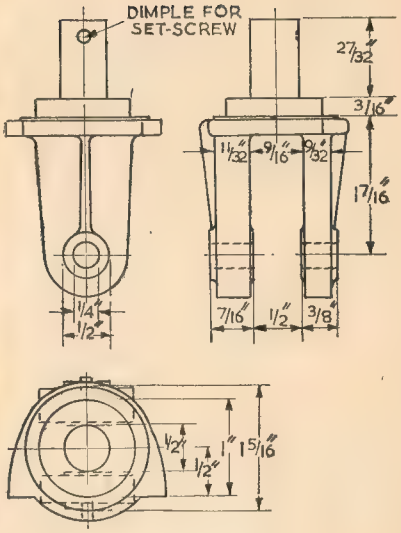
General arrangement of spud-pan



Dimensions of front axle



Photograph No. 72. Rear view, showing fork and turn-table more clearly



Fore-carriage fork

between centres, and the journals and collars finish-turned to sizes. Use a keen knife-tool, with the corner just rounded with a few strokes of a slip-stone. You will find a "half-centre" useful in the tailstock in finishing the ends to length.

Finally, draw-file the sides, top and bottom of the axle, and rub the corners with emery-cloth to remove the extreme sharpness.

Rubbing-plates

The rubbing-plates, on which the ends of the spring bear, are best end-milled from the solid. If you have a piece of $\frac{3}{8}$-in. × $\frac{1}{2}$-in. mild-steel, that's just the ticket, but I had to use $\frac{1}{2}$-in. square and mill off the surplus $\frac{1}{8}$ in., not having the smaller section.

A length of $1\frac{1}{4}$ in. of the bar was gripped in the machine-vice, mounted on the vertical-slide, and first of all the surplus $\frac{1}{8}$ in. was milled away, using a $\frac{5}{8}$-in. end-mill in the chuck. A cut of 1/32 in. was taken off the width also, and the bar replaced in the vice with the wide side outwards. The centre-line of the bar being carefully checked with the surface-gauge to see that it was truly at centre-height, a $\frac{3}{8}$-in. end-mill was used to mill a groove 3/32 in. deep across the work.

Having reversed the work in the vice, a $\frac{3}{8}$ in. wide groove was milled 7/32 in. deep in the other side, leaving the centre-web $\frac{1}{16}$ in. thick. The bar was next set at right-angles, and the ends cleaned up square. Following this, the work was sawn in two, and the sawn ends squared to leave the two pieces $\frac{1}{2}$ in. long. It was then an easy matter to file the slope and round the corners slightly, and to drill and countersink the No. 39 fixing-holes.

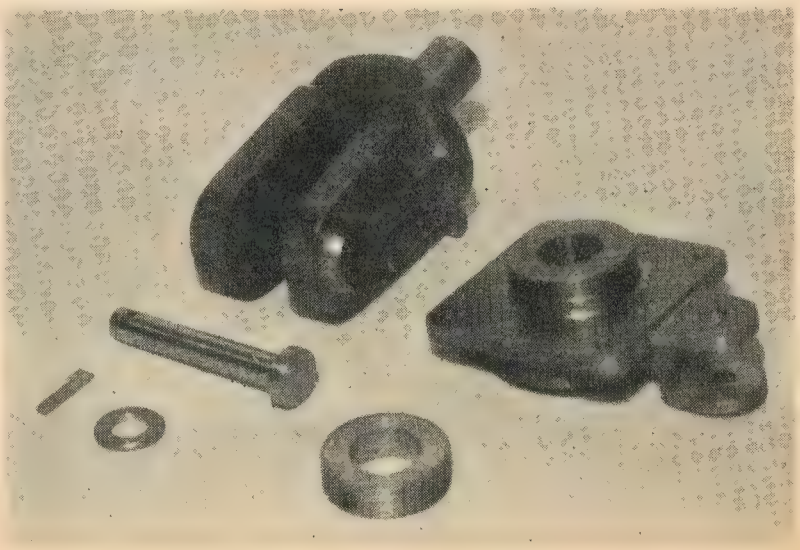
The plates are fastened to the upper surface of the axle with 7-B.A. countersunk screws, at $1\frac{5}{8}$ in. each side of the centre, and the grooves should be a nice tight fit on the axle.

Turn-table

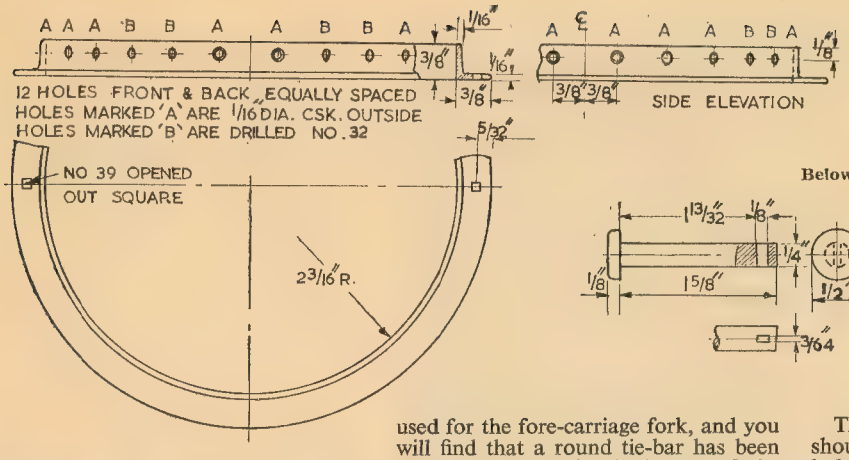
Another malleable iron-casting is used for the turn-table, and again the first step is to clean it up. There are one or two awkward corners which cannot be reached by filing, but I used old dental burrs—which my dentist is happy to give away—in these places. They can be gripped in the chuck of drilling-machine or lathe, and should be revolved at the fastest speed available.

The upper spigot of the casting has been left deliberately long for convenience in chucking for the boring operation. If your three-jaw chuck is reasonably true, you can carry on as follows, because it is not vital for the spigot to be *exactly* concentric with the bore, in this case.

Grip the casting by the underneath boss with the spigot outwards—the push-pole lug will fit between two of the jaws—and check to see that the spigot and the four corners of the platform run true. Take a roughing cut over the spigot, and rough-face the platform.

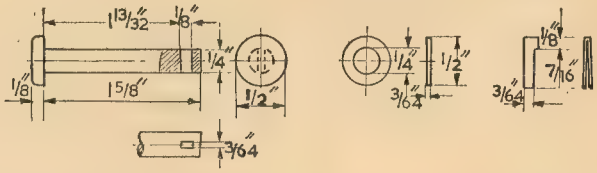


Photograph No. 73. Turn-table, fork, and other parts for model



Left.—Angle-ring for spud-pan

Below. -Axle-pin, washers, and cotter



Then with a keen knife-tool finish the spigot to 1 in. diameter, and finish the platform.

Reverse the casting in the chuck, and face up the lower bearing surface to $\frac{7}{16}$ in. from the upper one. Centre it deeply, and drill with successively larger drills up to 17/32. Finish the bore to $\frac{1}{2}$ in. diameter with a boring tool, and then counterbore the hole to 1 in. diameter and $\frac{3}{16}$ in. deep.

Whilst the boring-tool is mounted, clean out the radius at the back of the push-pole lug, where it projects downwards, to $\frac{3}{4}$ in. radius.

Remount the casting in the chuck with the spigot outwards and running true. Part off to length, and reduce the diameter of the upper part to $\frac{15}{16}$ in., leaving the inner $\frac{1}{8}$ in. length to full diameter, as shown in the drawing.

The push-pole lug should now be filed up to shape, and the holes drilled for the pin. Finally, set out and drill the four No. 30 holes for the bolts which will secure the turn-table to the perch-bracket, and drill the oil-hole $\frac{1}{8}$ in. diameter as shown.

Fore-carriage Fork

Still another malleable casting is used for the fore-carriage fork, and you will find that a round tie-bar has been left between the inside bosses of the fork. This serves two purposes—firstly to prevent distortion taking place in the annealing process at the foundry, and secondly so that the fork may be gripped in the four-jaw chuck without squeezing the jaws of the fork inwards.

After cleaning up the casting, grip it in the four-jaw with the spigot outwards and running true. Turn the outer spigot to be a good running fit in the bore of the turn-table, and the larger boss to be ditto in the counterbore. At the same setting, of course, you will face up the large bearing surface of the fork, and face the boss and the spigot to length.

Remove from the chuck, and saw away the strut between the inner bosses. If you wish to go to the trouble of setting up the fork on the vertical-slide, the surfaces of the bosses, inside and out, can be end-milled, but providing you can use a file with any degree of accuracy, I think it is easier and quicker to file them up. And may I suggest that if you aren't so proficient with this very valuable tool, it would pay you to practise its use ! A piece of bar $\frac{1}{2}$ in. thick should just slide freely but without shake between the inner bosses, when finished.

The centres of the holes in the bosses should be set out carefully, and $\frac{3}{16}$-in. holes drilled separately from each side. These may then be checked to see if they are in line with each other, and square with the inner bosses, as they should be. If not, the holes may be "pulled over" as necessary with a small round file, and a 7/32-in. drill put through them.

Check again for squareness, and if O.K. this time, follow through with a 15/64-in. drill straight through both holes; finish the holes with a $\frac{1}{4}$-in. hand reamer through both.

Regarding the lugs for preventing steerage overlock, it will be as well to leave the final filing of these until the trial assembly of the complete engine is made. They, and the push-pole lug, may be adjusted then so as to permit a good lock without the front wheels fouling the boiler-lagging. But don't forget to allow enough clearance for the axle to be "tipped up" on rough ground.

The retaining collar for the fork is simply turned up from an odd length of 1-in. diameter mild-steel. It should be a good fit on the spigot of the fork, and is tapped 4 B.A. for Allen set-screw.

Axle-pin

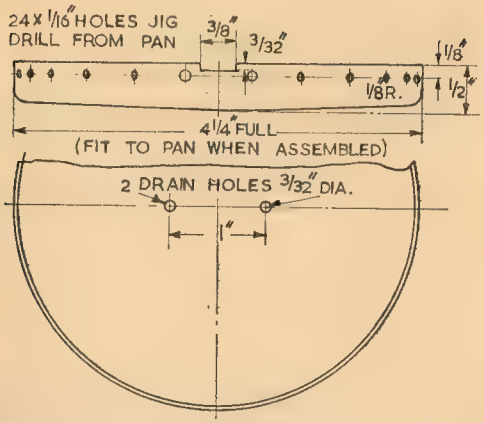
To make the axle-pin, grip a length of $\frac{1}{2}$-in. diameter mild-steel in the three-jaw chuck, and reduce it to about 17/64 in. diameter for a length of $1\frac{5}{8}$ in. full.

Remove from the chuck, and saw the slot in the end, finishing it to a breadth of 3/64 in. with a slim flat file. Insert a scrap of steel, as shown for the studs for the retaining-collars of the driving-pins, and silver-solder in place, to leave the slot $\frac{1}{8}$ in. long.

File off any surplus, then replace the rod in the chuck and finish-turn it to $\frac{1}{4}$ in. diameter. Take a skim off the end, and then part off to leave the head $\frac{3}{8}$ in. full long. Grip the pin by the $\frac{1}{4}$ in. diameter, face up the head and take a skim off the full diameter. Slightly round the outer corner with a smooth file.

The cotter for this pin can be made from 20-thou. shim steel, but I utilised

Photograph No. 74. Completed front axle and spud-pan for model



Bottom of spud-pan

some of that useful thin flexible steel strip which is used for binding packing-cases. All that has to be done is to cut a strip about $1\frac{3}{16}$ in. long and 5/32 in. wide, bend it double, and file to shape. If it has a tendency to crack—but mine didn't—a touch of silver-solder will cure that after bending.

Tip for Washers

For the washers, I found that commercial $\frac{3}{16}$ in. turned articles were just right. They were gripped in the three-jaw chuck, and opened out with a $\frac{1}{4}$-in. drill, but it wouldn't be a long job to turn and part a couple off from a stub $\frac{1}{2}$-in. rod, if you haven't suitable ones available.

Spud-pan

The angle-ring of the spud-pan is turned from a casting. Mount the "inside" jaws in the three-jaw chuck, and grip the ring on the vertical-web, with the horizontal flange outwards. Face the bottom of the ring, and turn the outside to $5\frac{1}{8}$ in. diameter. Slightly round the outer corner with a smooth file, and bore out the inside of the ring to $4\frac{3}{8}$ in. diameter.

Change the chuck-jaws, and reverse the job, setting the bore of the ring on the outside steps of the jaws. Note carefully: Because of the thinness of the ring, don't tighten the jaws unduly, and take only light cuts. Turn the outside of both webs, to leave them $\frac{1}{16}$ in. thick and $\frac{3}{8}$ in. wide, and round the corners slightly. There should be a slight radius in the "meeting" corner, as indicated in the drawing.

The bottom of the spud-pan, in big sister, is flanged from steel-plate, and for the model it may be made from 18-gauge brass sheet, flanged on a turned iron or steel former, or even one of hardwood, of suitable size. Alternatively, you may prefer, as I did, to use the casting which is available.

This has a chucking-spigot on the underside, which should be gripped in the three-jaw chuck. First clean up the outside of the flange, and the inside of the bottom, with roughing-cuts, and then finish the outside diameter to $4\frac{1}{4}$ in. full—the exact size can be gauged from the bore of the angle-ring, with two scraps of 18-gauge sheet as packing.

To finish the inside of the pan, I used hand-tools; a round-nosed tool for the inside of the flange and the corner, and a graver for the bottom. This is a method to be recommended for many people, for most lathes do not allow the top-slide to be set at a sufficient angle to machine the bottom with an ordinary slide-rest tool, and you'd have to manipulate the two handles. (The Super 7 is an exception to this, for the top-slide can be swivelled through 360 deg.)

When this part of the machining is done, the pan is removed from the chuck, and the spigot sawn off. The two 3/32-in. drain-holes may now be set out and drilled, which will enable you to keep a check on the thickness of the bottom in the next operation.

To turn the underside of the bottom, mount the casting on the outside jaws of the three-jaw chuck, and once more hand tools will be more satisfactory than the slide-rest tool, though the roughing may be done with the latter. Here again, too much tightening of the jaws would distort the work, which means light cuts is the order of the day.

(To be continued)

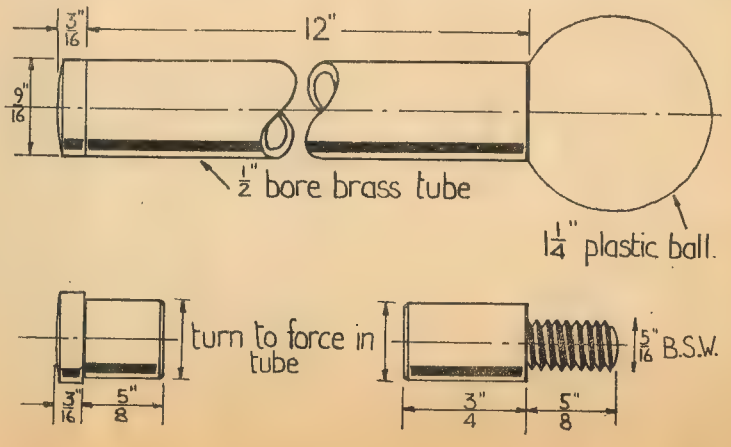
A LATHE CENTRE EXTRACTOR

By A. Smith

IT has long offended my more sensitive feelings to have to use an odd length of steel bar to remove lathe centres, drill chucks, drills, etc., from the tapers of headstock mandrel and tailstock barrel. I had for a long time thought that a centre extractor ("bumper" to the more common amongst us), was desirable, but as the lathe was an M.L.7 with an approximately $\frac{5}{8}$ in. bore through mandrel and barrel, it meant that the extractor had either to be of small diameter, and very sloppy or else fit the bores fairly closely, but be very heavy and cumbersome.

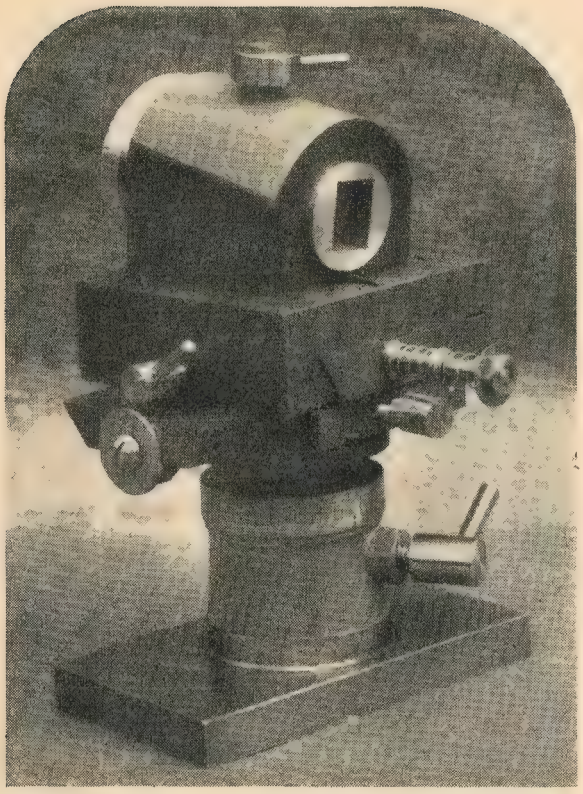
An odd piece of brass tube of $\frac{1}{2}$-in. bore and 20-gauge proved the answer. This was cut off to 12 in. long, mounted in the lathe, the ends faced and the surface polished with fine emery-cloth and finally metal polish. A small piece of light alloy rod was then mounted in the three-jaw chuck and machined to form a plug for the business end of the extractor. The end of this plug was domed slightly, similarly to a hammer face, to prevent it "mushrooming" in use. A tight fitting plug was then turned for the other end and threaded $\frac{5}{16}$-in. B.S.W. to take a $1\frac{1}{4}$ in. diameter black plastic ball. These black balls are invaluable to the engineer who likes making tools and machines for the workshop, as they give a really professional finish to the work. They are obtainable from The Ray Engineering Co., Southmead, Bristol, and cost around 1s. each.

The various parts were then assembled and given a final polishing, so forming an extremely useful, easy-to-handle, good-looking tool which one could not possibly call a mere common or garden "bumper," hence the term, "extractor."



A Universal Tool-grinding Appliance

By John D. Elam



The assembled tool grinder

FREE-HAND grinding of lathe tools, etc., is at the best unsatisfactory, for each time one examines progress a new facet is produced.

For some time I had promised myself to construct a mechanically-controlled grinder, and the one described is the result. It is all new construction, with the exception of the longitudinal slide—which was part of an old compound slide-rest of very doubtful use; built from a design in a journal very many years back. It will be noticed that there are no less than five independent movements at the control of the operator.

The tool to be ground is placed in the revolving quill *A* which is indexed to read 0-90 deg. either side of zero mark on the head, whichever shape of tool is in quill, the latter being secured at the angle desired by clamping-screw in head *B*, which has a fixed 8 deg. front clearance angle.

This head also swivels on a stud fixed in cross-slide, the latter being indexed to give angles of 45 deg. each side of zero, and is clamped by a screw inserted in side, whose point is formed to an included angle of 90 deg., impinging on the undercut 45 deg. stud, which very effectively locks head to slide.

The movement of cross-slide *C* is controlled by the follower-rod *D*, which has two discs attached to cause interference with its base when extruded, the light springs returning the rod when slide is retracted.

As will be observed, this cross-slide is mounted on the longitudinal slide *E*, on which it freely moves between end checks, but can be locked in any position by clamping bolt. This longitudinal slide is mounted on a pedestal *F* which takes a bearing in base *G*.

On this pedestal a height adjusting collar *H* is secured, which has its whole perimeter indexed in 5 and 10 deg. divisions, the zero mark on base should be so placed as to agree when front edge of base and longitudinal slide are parallel to each other.

It should be noted that the pedestal graduations and head graduations are complementary to each other, as it may not be too convenient to swivel longitudinal slide alone to get the desired angle, in which case the desired angle can be divided between longitudinal slide and swivelling head.

The slides should be a nice sliding fit, but without shake, so that the grinding pressure can be easily felt, and so prevent overheating. By making adaptors for the quill, any smaller size of tool or tool-bit can be held by suitable Allen screws.

It will be found a great advantage if a length of the tool shank is brightened and given a coat of etching varnish, and through this scratched, say: C.A. (cutting angle) "x" degrees; S.R. (side rake) "y" degrees, and nitric acid applied for a few minutes, afterwards washed off and varnish removed. Then on regrinding, one can set the tool in grinder to these readings, and touch up original surfaces. Side clearance angles may as well be standardised to say 5 deg. (less for parting-tools) and, therefore, need not be etched on tools.

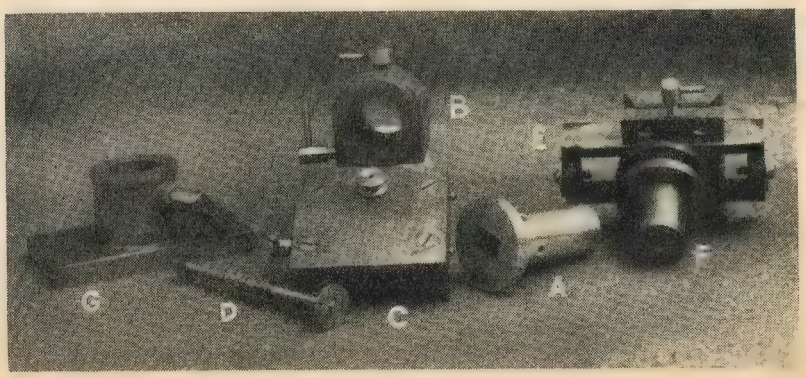
A double cupped wheel will be found of great advantage, but not a necessity.

Having made patterns, castings were obtained in cast-iron, with the exception of tool holding quill, which was a cored aluminium casting. Had this latter been cored with the care requested, it would not have needed machining, but, alas, it was badly executed, so had to be machined out on my small planer.

I always make it a practice with iron castings to "fire" them up to a cherry-red, and allow same to cool off slowly. This not only takes away the chilled hard skin, but relieves any stresses, after which they are pickled to remove any embedded sand. This makes tooling a pleasure.

The base can be trimmed up, turned

(*Continued on page* 368)



Machined components—ready for assembling

MAKING A MINIATURE VICE

By "Duplex"

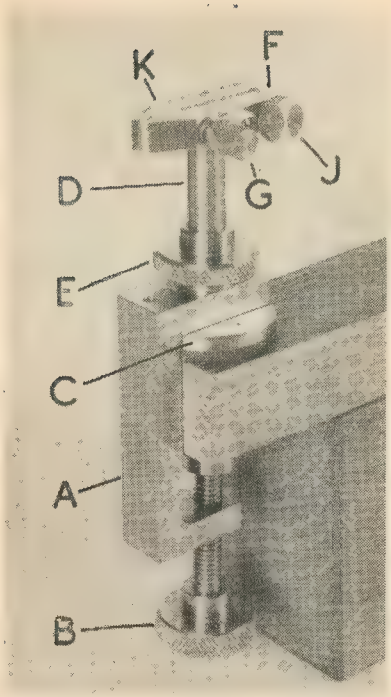


Fig. 1. The finished vice. A—the frame; B—the clamping-screw; C—the clamp plate; D—the pillar; E—the pillar clamp collar; F and K—the vice jaws; G—the setting-screw; J—the jack-screw

THE miniature vice illustrated in Fig. 1 was made for doing light work on very small parts, and it has been found particularly useful when dealing with batches of components; for once it has been set, any number of similar parts can be securely held by tightening a single screw. A vice of this kind may, perhaps, appeal to ship modellers for holding the parts of deck fittings and rigging appurtenances.

The vice is designed for clamping to the edge of a table and, so that no damage will be done, the pressure plate of the clamp is lined with a leather disc. Provision is made for rotating the column to bring the vice head into a convenient working position; the vice jaws are made to open to ¼ in., but this can be increased, where needed, by fitting longer adjusting screws.

The Table Clamp A

This part is best made of mild-steel and cut out of the solid. The integral boss on the upper surface was formed by machining the clamp when mounted between the lathe centres. For this purpose, the centres for the boss and the clamp-screw were first marked-out and then centre-drilled.

The clamp-screw B was also machined from the solid as, although this used more material, it may possibly be found quicker than making the parts separately and afterwards pinning them together.

The loose head should rotate freely after it has been assembled with a retaining grub-screw engaging in a groove turned in the end of the clamp-screw. The circular clamping plate C is fixed to the under side of the upper limb of the clamp with two screws, and the leather disc is then secured in place either with Bostik cement or with countersunk screws.

The Pillar D

A short length of $\frac{5}{16}$ in. dia., round, silver-steel is threaded 40 t.p.i. at its lower end, and either 4 B.A. or 6 B.A. at the upper. The knurled locking collar E is recessed at its upper end to hide the threads on the pillar.

By first slackening and afterwards tightening the collar, the vice head can be secured in the most convenient working position.

The Vice Head

As will be seen, this is actually a small toolmaker's clamp made from two short lengths of ¼ in. square mild-steel or silver-steel. The two jaws, after being filed flat and square, are gripped together in the machine vice for drilling and tapping the cross holes shown in the drawing.

The tips of the jaws should be well tapered, but there is no need to case-harden these parts, as they are not subjected to any great pressure. The forked bridle H should be accurately fitted in order to maintain the moving jaw F in contact with the head of the setting-screw G. The head of the clamping-screw J is made larger in diameter, as it is tightened to close the vice on the work after the jaws have been set approximately parallel by means of the screw G.

When assembling the finished vice, the vice head should be screwed firmly on to the pillar, and there may then be no need to fit a grub-screw to increase the hold.

An alternative method of making the two jaws is to take a single piece of mild-steel bar, and after the screw holes have been drilled and tapped, the material is sawn in half lengthways and the jaw faces are filed square.

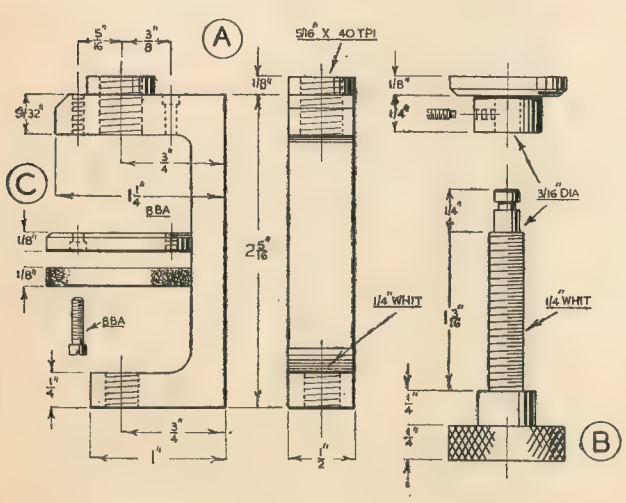


Fig. 2. The frame and clamping-screw

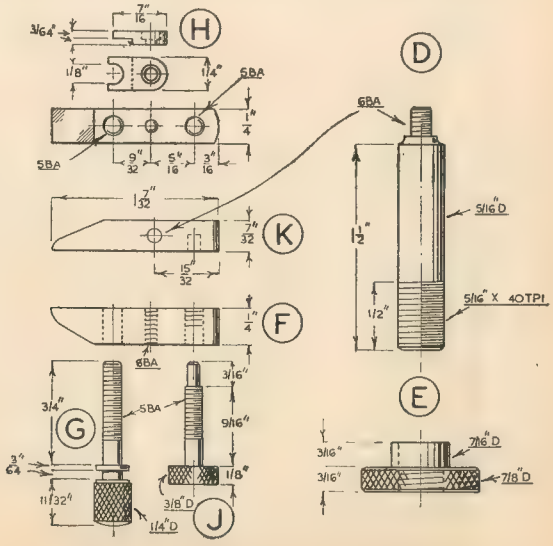


Fig. 3. The pillar and the vice head parts

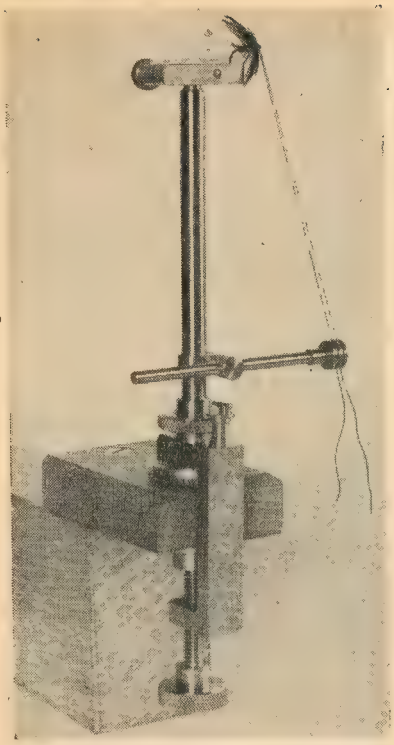


Fig. 4. The vice adapted for fly-tying

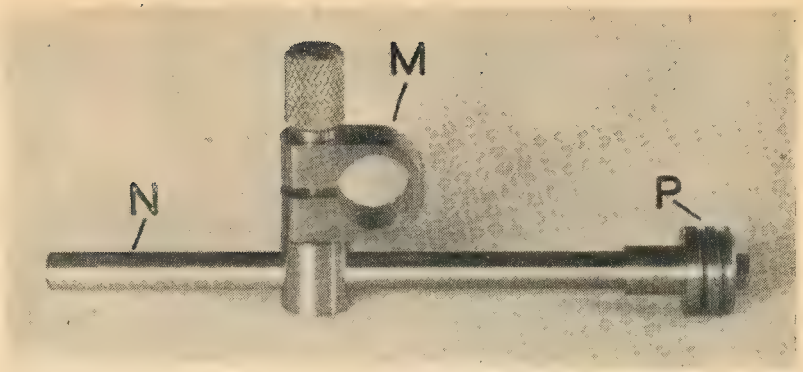


Fig. 5. The silk holder. M—the pillar clamp ; N—the spindle ; P—the spring-loaded discs

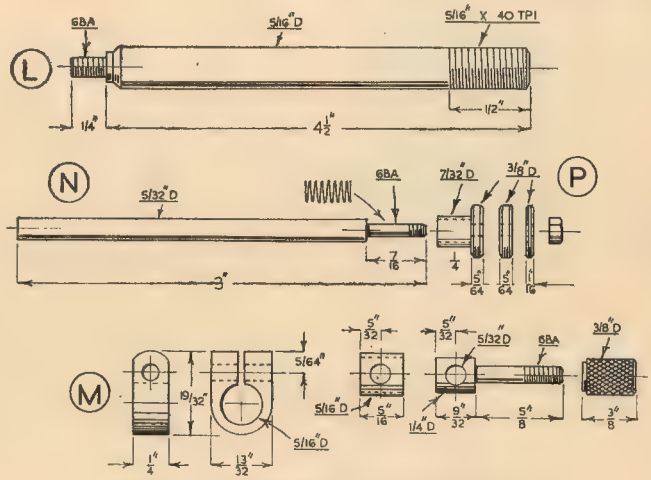


Fig. 6. The silk holder and the long pillar—L

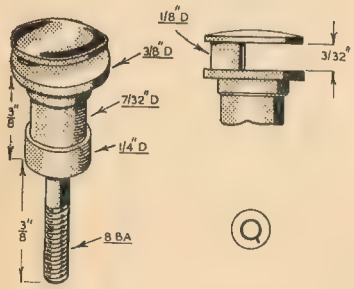


Fig. 7. The waxing hook

A further addition is what is termed a waxing hook ; this small fitting Q screws into the upper surface of the table clamp and holds the loop of the tying silk while the thread is lightly rubbed with wax.

For Fishermen

With but slight modification, the vice has proved most useful for tying the artificial flies used for fishing and, for the benefit of those interested, working drawings are given showing the necessary alterations.

The pillar L is made longer, to give more working room below the vice head, and also to enable a device to be fitted for holding the ends of the tying silk. This fitting is mounted on the lower part of the pillar in an adjustable clamp M, so that the holder can be set in any position required. The spindle N of the silk holder is fitted with three chamfered discs P, which are maintained in light contact by means of a small compression spring. In this way, the free ends of two silks can be securely held when drawn in between the discs.

A UNIVERSAL TOOL-GRINDING APPLIANCE

(*Continued from page* 366)

and bored in the lathe, also pedestal, head and part of cross-slide. The fitting of V-ways must be left to the ingenuity and equipment of the worker; a shaper or planer really is the job—I have the latter.

Indexing was done from a 72-hole division plate, which gives 5 deg. readings. In fitting gibs to slides, I scrape to a satisfactory state and then lap with No. H.500 O.F. Carborundum Lapping Compound, which gives a beautiful satin-like surface after washing off with paraffin.

The dimensions of the various components of the appliance are as follow :

(*A*)—Quill (front) $2\frac{1}{8}$ in. diameter, $\frac{5}{16}$ in. thick. Body $1\frac{1}{4}$ in. diameter, $3\frac{1}{4}$ in. long overall. Tool-holder 13/16 in. × 19/32 in.

(*B*)—Head base, $2\frac{1}{2}$ in. × $2\frac{1}{4}$ in. Height (front) $3\frac{5}{16}$ in., (rear) $2\frac{15}{16}$ in. Bore $1\frac{1}{4}$ in.

(*C*)—Cross-slide, $3\frac{1}{2}$ in. × $3\frac{3}{8}$ in., $1\frac{1}{8}$ in. deep overall. Fixed way $2\frac{1}{2}$ in. wide, with gibs, $3\frac{1}{4}$ in. wide.

(*D*)—Follower, $\frac{1}{4}$ in. diameter × 5 in.

(*E*)—Longitudinal slide, 5 in. × $2\frac{1}{2}$ in. by $\frac{1}{2}$ in. thick.

(*F*)—Pedestal, $2\frac{1}{4}$ in. diameter where attached to longitudinal slide. Total length, $2\frac{5}{8}$ in., diameter $1\frac{1}{4}$ in.

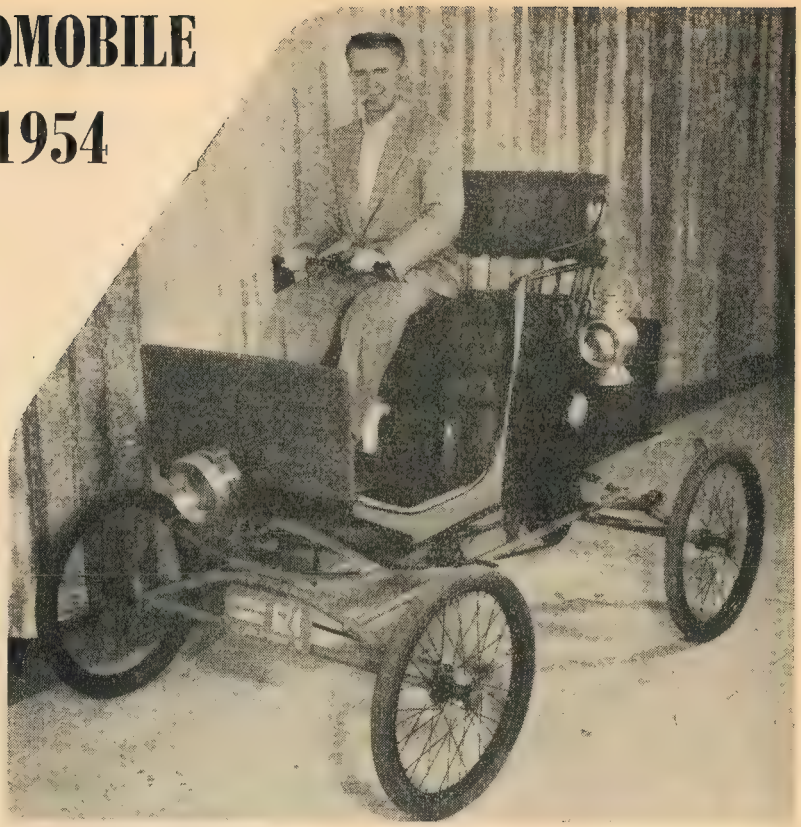
(*G*)—Base, 5 in. × 3 in., height, $2\frac{3}{8}$ in., outside diameter $2\frac{1}{4}$ in., bore $1\frac{1}{4}$ in.

(*H*)—Pedestal collar (graduated), $2\frac{1}{4}$ in. diameter $\frac{3}{8}$ in. thick. Head clamping-stud, $\frac{3}{4}$ in. diameter × 11/32 in. Overall height of grinder (less clamping-screw) $7\frac{3}{8}$ in.; bench to bottom of tools in quill, $5\frac{3}{4}$ in.

THE 1900 LOCOMOBILE STEAM CAR IN 1954

By G. Rosekilly

(America)



RECENTLY a local movie house was showing the British film "Genevieve," which has to do with a 1904 automobile.

A friend, Mr. Lee Pinkston, has a 1900 Locomobile Steam Car (or it may be an 1898 model) and was asked to show it at the theatre, while the film was being shown.

On the way to the theatre, he stopped at a stop light and a 1954 Oldsmobile came up, looked, laughed, and said: "Dig me?" "Sure," said the old steamer and when the light changed he took off and left the Oldsmobile howling behind. At the next corner, the Locomobile had made a U-turn before the Oldsmobile got there plenty mad at being "made a fool of by that . . . steam bicycle thing you got there"!

This same car, on its first appearance after being rebuilt, won two prizes, one for the oldest car present and the other for the most acceleration. Last November at the "Custom Car Show," San Francisco, it left a number of "hot-rods" behind to their astonishment.

How was this museum piece brought to such a performance?

A baker owned the car and a 1906 Maxwell, in San Francisco, and in 1914 he found the traffic too much for him and laid both cars up. He died around 1952-3, and the cars were both sold. Both are running.

When the Locomobile was first received, it had a very poor firebar-furnace arrangement for solid fuel, a copper boiler about 14 in. diameter by 14 in. high, with 297 ⅛ in. copper tubes in it, a copper drum wound with piano wire, and steel end-plates. It leaked all over. This was duly restored to carry 300 lb. sq. in cold test, while the entire car was restored equal to or better than new, there being over 40 coats of black lacquer on the woodwork. The tubular frame was taken apart and new tubes fitted inside to give strength without changing the appearance. Copper fuel tank, air and water tanks were all cleaned, polished and made tight. The crosshead-drive engine-operated water feed-pump was persuaded to operate in excess of the amount of water required by the boiler, a hand by-pass taking care of the excess. A separate hand pump can be used but is not often needed.

A water gauge was fitted on the outside of the body, about where the whip socket would be in horse-drawn days, and this being invisible from the driver's seat, a "rear view mirror" was so arranged to show the water level. Try cocks were fitted inside the body, and the ball-bearing double-acting two-cylinder engine drove the rear axle through a single chain. Sprockets, engine and all, out in the open. Differential gears also exposed. Full elliptic springs all around. One acetylene headlight and two oil lights.

The vertical boiler was located most conveniently just below the drivers' seat, a banjo-shaped piece of tin-ware comprising the smokebox and connecting to the "stack" which went down through the rear water tank and discharged just by the differential.

The car was run this way and a great deal of fun was had, as well as experience. Of course, the first thing was to do away with the solid fire and use an oil burner.

A great many different kinds of oil burners were tried, as well as many different kinds of pilot burners; finally the question was solved with a Coleman stove-type of burner, and with this and using "white gasoline," that is, untreated gasoline, the burner can be got going and pressure raised in 30 sec.

However, the fire-tube boiler and the manual controls proved entirely too much to handle, so the old boiler was removed and a set of stainless-steel pancake-wound coils was installed, weighing only a fraction of the copper boiler. It was quickly found that with the burner at the bottom, the water had to come in at the top, steam being taken from the bottom coil. At first try, the paint all came off the engine due to heat, the engine worked expansively almost to the mid-point, as never before, the steam now being up to pressure and plenty hot, and the entire car took on a different feel altogether.

An automatic regulator was made up, with a diaphragm-type valve, to control the burner, so that when the pressure dropped the fire came on; when the pressure is up, only the small pilot light keeps the vaporiser and boiler warm.

Another big step forward was the fitting of a thermostatic control to the boiler so that if it got too hot, the steam pump would start up (the bypass being now a thing of the past) and pump cold water until the temperature dropped. In this way, the boiler is covered both ways, it cannot get too hot and it is always warm and enough steam available to get going. The water gauge and try cocks remain, but are not used at all.

Those of us who are accustomed to bigger boilers will be interested to know that when running along the road one's hand can be placed on the top coil of

(*Continued on page* 373)

COLOURING AND PLATING COPPER AND COPPER ALLOYS

By R. D. Richards, A.M.S.E., M.I.Plant E.

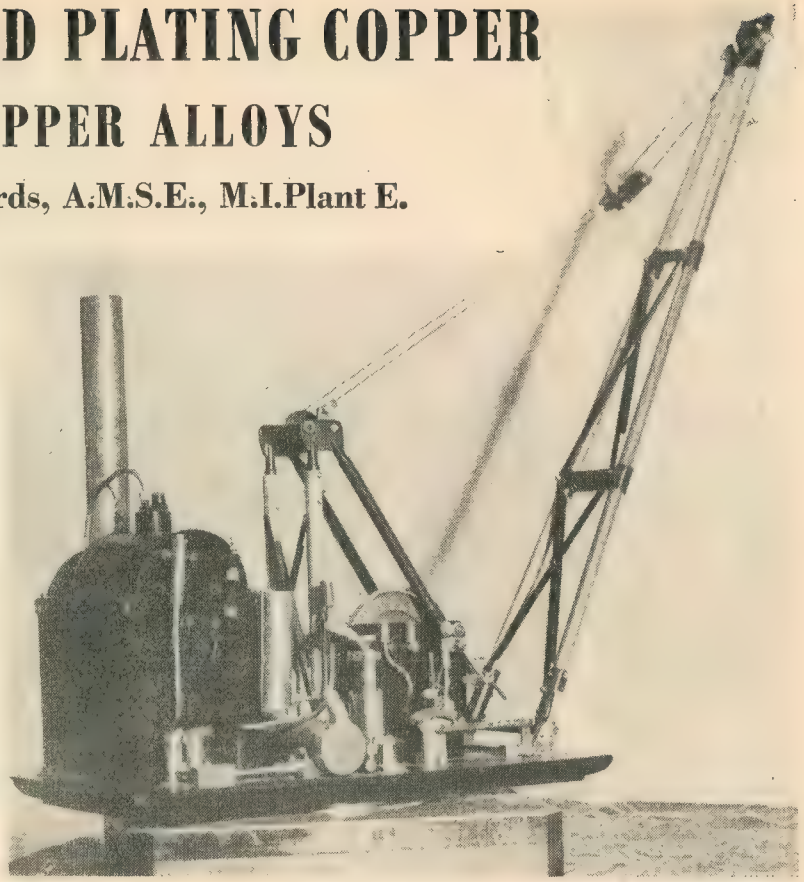
COPPER alloys, along with the parent metal, have no small part to play in the field of small engineering, instrument, horological and model work, although this article, in the main, is addressed to the amateur enthusiast in the first and last categories whose efforts in small scale work delight us all.

Unfortunately, our unkind British climate does not, for long, leave untarnished the gleam and lustre of polished brass and copperwork, insidious oxidation soon reducing to nought many arm-aching hours of spit-and-polish application.

Painting, of course, has its champions and indeed is often a necessity, but that has its limitations for small parts and instruments.

Electroplating has also a narrow scope for most of us, chiefly on account of its expense and the fact that the tackle required to carry it out successfully is often outside the scope of our humble workshops and, perhaps, our knowledge and experience.

In circumstances such as these we may have recourse to chemical colouring and plating of many component parts, however, and with judicious selections, combined perhaps with painting, very effective surface finishes may be applied which will enhance the appearance of that clock, or mill engine, or microscope which now occupies our leisure thoughts and energies. Naturally the individual must select a scheme to suit his taste and the requirements of the job in hand; but to give an example, a copper vertical boiler finished in gleaming black with all fittings tin-plated, to represent chromium plating, really is a sight to gladden the heart of any enthusiast. Many other applications could be quoted, such as bronzing the hinges, locks and hasps of pianos and furniture, silvering clock dials, blueing brass and copper pipes to represent cleading on steam mains, etc., but the reader will readily assume his own requirements.



A model crane under construction, plated and coloured

Materials

These are easily obtained from most pharmacies, are comparatively cheap, can be bought in small quantities economically and have the advantage of lasting well when stored. Acids must be stored in glass jars or bottles, with glass stoppers, while the "dry" materials are best kept in glass jars with screw tops, such as hair-cream jars.

The vessels used may be glass ovenware, for small articles, ranging through vitreous enamelled pudding dishes, wash-bowls and even buckets for use as boiling pans for large articles, provided care is taken to neutralise any acidic effects by washing out with a strong solution of common soda and water after use. This pre-supposes one is on the right side of the domestic authorities, but in actual fact it is best to keep one or two enamelled vessels solely for chemical coating. Acid dips are best contained in glazed earthenware vessels or lead-lined wooden boxes, although glass jars and vessels are also suitable for the actual dipping processes.

Durability

These finishes, while being vastly superior to the bare polished metal, are not claimed to possess the life of hard deposits such as silver, nickel, cadmium or chromium, but it will be found they last a good long time, years in most cases, with ordinary handling. It must be stressed that the surface finish and polishing of metals plays a big part in ensuring successful plating; the better the polishing, the better the ultimate plating. Washing must be scrupulously thorough.

Quantities

The quantities given are purely nominal amounts, to help determine the ratio of ingredients, and may be decreased or increased according to individual requirements. In particular, tin may be used over and over again giving good results for many months or years.

Preparation of the Work

Acid dips are used for cleaning prior to plating or colouring, and those given below are suitable for copper and its alloys. Always add the acid to the water. Use glass, earthenware or enamel vessels.

First Dip—Oxide Removal

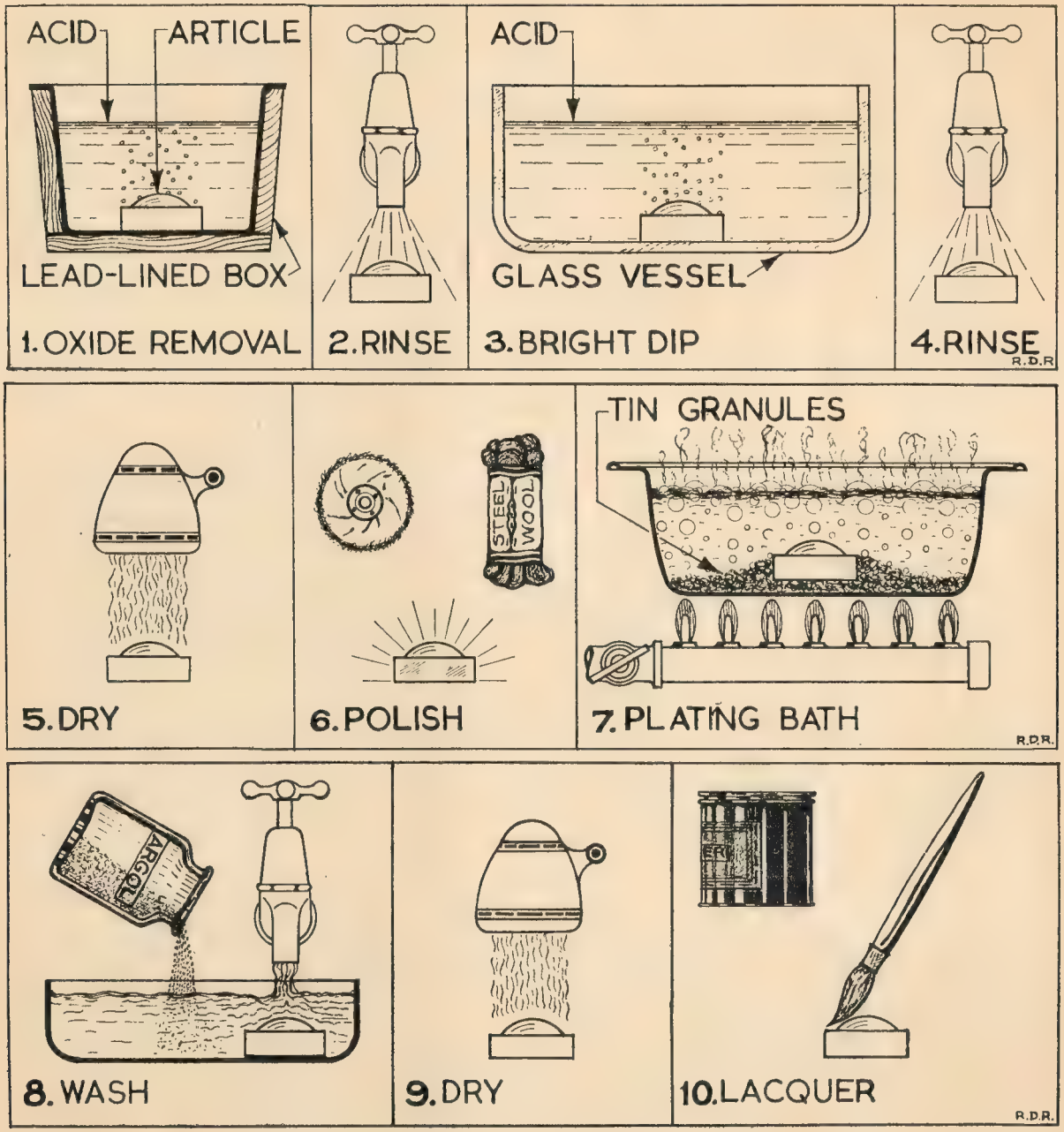
"A" Solution—1 part strong nitric acid added to 8 parts of water, by weight.

"B" Solution—1 part strong nitric acid added to 4 parts of water, by weight, straw coloured.

Method—Pickle article in "A" solution until a uniform bright surface is produced, wash well in running water. Pickle article in "B" solution until a curd forms or minute gas bubbles cover the article. Wash well, dry in warm current of air.

Second Dip—For a Bright Surface

"C" Solution—1 part strong sul-



Typical sequence of operations for, say, plating any article

phuric acid added to 8 parts of water.

"B" Solution—as above.

Method—Heat article to 200-300 deg. F. Plunge into "C" solution, avoiding splashes and gassing. Pickle in "B" solution until bright. Wash in running water, then dry.

Third Dip—For Finishes which are to be Lacquered.

"D" Solution—Concentrated nitric acid.

Method—Plunge article into solution for a few seconds, taking care against ebullition and fuming, then immediately wash in water. Rinse article in a solution of argol and water, dry well and lacquer.

Fourth Dip—For Dead Gold Finishes

"E" Solution—1 part hydrochloric acid added to 1 part alum.

Method—Immerse article for 4 sec., taking precautions against splashing, etc., then plunge immediately into a solution of argol and water. Wash and dry well.

Fifth Dip—For a Matt Finish

"F" Solution—200 parts strong nitric acid, 100 parts strong sulphuric acid, 1 part common salt, 2 parts sulphate of zinc, by weight.

Method—Immerse article until desired effect produced, wash in running water and dry.

Sixth Dip—For a Matt Finish

"G" Solution—6 parts strong nitric acid, 2 parts sulphuric acid, 2 parts water, 1 part sulphate of zinc, by weight.

Method—Dip article in the solution,

rinse well in water, continue to dip and rinse alternately until the dull yellow colour gives way to a clear matt without any trace of "earthiness." Rinse well and dry.

Preparation for Colouring Steel Parts

These are first chemically cleaned using an acid dip, as given above, then rinsed, dried and copper-coated prior to colouring. Coating may be carried out by electroplating, or alternatively the following solution may be used for immersing the article:

Copper sulphate crystals dissolved in water to make a "saturated" solution, the clear liquid being decanted for use and a few drops of sulphuric acid added. A thin uniform coat without blemishes must be obtained. Article is then washed and dried.

Colouring and Plating

(1) *Golden Yellow.* Solution—100 grains lead acetate dissolved in one pint of water, to which is gradually added a solution of sodium hydrate until the precipitate first formed is re-dissolved. Then add 300 grains of red potassium ferricyanide. Caution—This solution is very poisonous, do not inhale fumes, and work in the open or in a well ventilated shop.

Method—Polish work, immerse work in solution at room temperature until colour becomes golden yellow, wash well in water, dry.

(2) *Brown.* Proceed as for (1), but keep the solution at a temperature of 125 deg. F.

(3) *Yellow or Orange.* Solution—5 parts caustic soda, 50 parts water, 10 parts copper carbonate.

Method.—Polish work, immerse in solution at room temperature, when the desired shade is obtained, wash well in running water and dry.

(4) *Dark Yellow.* Solution—Saturated solution of common salt containing some free hydrochloric acid, then add as much ammonium sulphate as the solution will dissolve.

Method—Clean and polish work, immerse for about 5 min., wash and dry.

(5) *Rich Gold.* (*a*) Solution—2 parts saltpetre, 1 part hydrochloric acid, 1 part common salt, 24 parts water, 1 part alum, all by weight.

Method—Clean and polish article, boil in solution, wash and dry.

(*b*) Solution—6 parts saltpetre, 3 parts common salt, 3 parts alum, 3 parts sulphate of zinc, all by weight.

Method—Clean and polish article, then apply solution to it by brush or other means. Heat article on a hot-plate, or by means of a bunsen burner, until solution turns black. Wash well in water, rub over with vinegar, wash and dry.

(6) *Rich Bronze.* Solution—4 pints water, 1 ounce photographic hypo, 1 ounce alum.

Method—Using a vitreous enamelled vessel boil solution only until black, taking care against ebullition. Clean and polish article and boil in solution until desired colour is reached. Wash and dry.

(7) *Pale Copper on Brass.* Solution—Zinc chloride.

Method—Have solution gently boiling; clean and polish article. Heat article over a fire of charcoal, free from all smoke, until it turns blackish-brown. Immerse in solution, wash and dry.

(8) *Green.* Solution—2 ounces sal ammoniac, 4 ounces liquid ammonia, 2 ounces common salt, 8 pints water.

Method—Clean and polish work. Immerse article, or paint solution on. Wash. Then continue alternately immersing and washing until desired shade is obtained. Finally wash, dry and lacquer. Caution—Work in open on account of fumes.

(9) "*Steel Blue*," *Violet and Black.* Solution—2 ounces lead acetate, 2 ounces photographers' hypo, 8 pints water.

Method—Boil solution until black. Clean and polish article, degrease, wash, immerse in solution until required colour obtained, maintaining solution at 175 deg. F. Wash well, dry and lacquer. Caution—Avoid breathing fumes, which are very poisonous, work in open. Note—Use an enamelled vessel, take care of ebullition. For steel parts, copper dip first. The colours run: Golden Yellow, Violet, Blue, Green and finally Black.

(10) *Black*—(*a*) Proceed as for (9), but using potassium permanganate crystals instead of lead acetate.

Method—Boil article in solution until uniformly black. After washing and drying, apply black-lead and finish by brush-polishing.

(*b*) Alternatively, where the article may be heated up to 300 deg. F.

Solution—Saturated solution of cuprous nitrate made by dissolving copper granules in concentrated nitric acid, until ebullition and fuming ceases, then decanting the clear liquid for use when cold. Exercise care to avoid accident as the reaction is violent and the fumes are corrosive. Add a small amount of copper at a time and work in the open air to windward of vessel used.

Method—Clean and polish article.

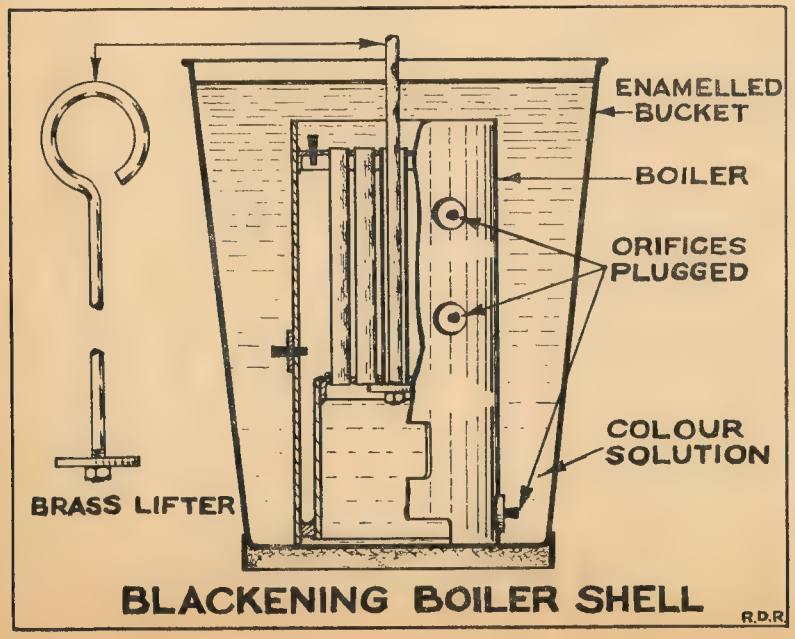
(i) Heat article to 250 deg.-300 deg. F. over a non-luminous gas burner or blowlamp.
(ii) Immerse immediately in, or paint on, liquid ammonia, avoid breathing fumes.
(iii) Immerse in, or paint on, the cuprous nitrate solution.
(iv) Heat article to dry solution, continuing until green colour is burned off and assumes a brown-black appearance. Repeat (i), (ii), (iii) and (iv) in sequence several times, then
(v) Immerse in ammonia, (vi) Brush off oxide, (vii) Heat to 100 deg. F., (viii) Rub lightly with olive oil on a soft cloth, (ix) Heat gently to dry oil, (x) Polish with a soft cloth, (xi) Lacquer, if required.

(11) *Bright Tin Plating.* Solution—2 ounces Cream of Tartar, 8 ounces Granulated Tin, 4 pints of water.

Method—Clean article well, polishing to a mirror finish. Boil work in the solution until desired coating is obtained. The time varies from 5 to 30 min. usually, depending upon the size of the job. Wash well in running water, then dry.

For steel parts, copper-dip first.

Note—This is an ideal method for tinning brass and copper parts, where

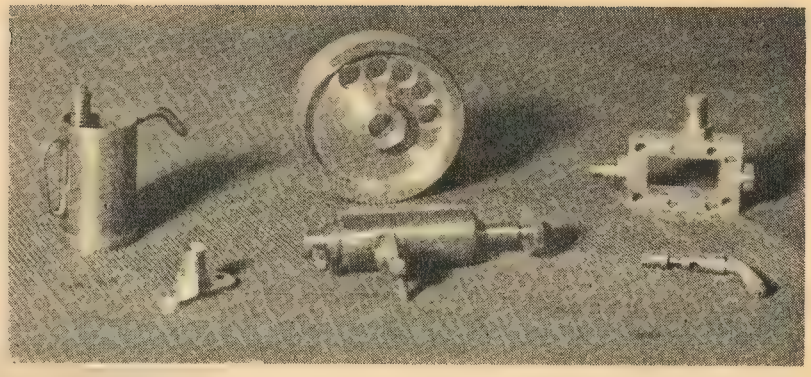


soft soldering of delicate or particular work is to be done.

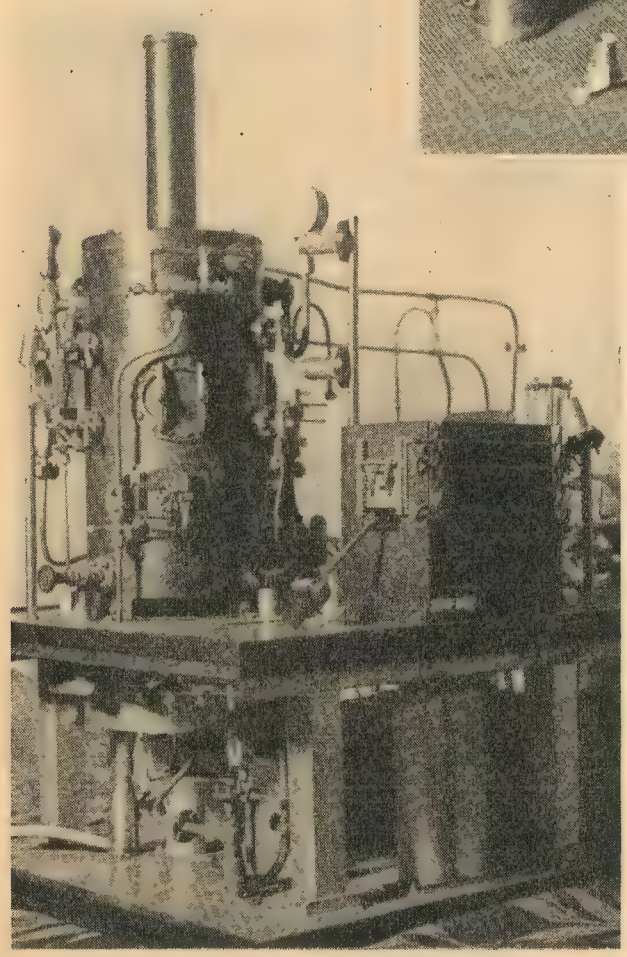
(12) *Silver Plating.* Solution—2 ounces cream of tartar, 3 ounces common salt, 1 ounce silver nitrate, enough distilled water to mix ingredients to a creamy consistency.

Method—" Grain " the article with Water of Ayr stone or fine, almost dead smooth, emery-cloth. Rub on the solution gently with a soft cloth, persevering until a coat of silver is built up. Wash article in hot water, then rub gently with a mixture of water and cream of tartar alone, on a fresh cloth. Wash in warm water, dry and lacquer. During the coating process it is advantageous to sprinkle a little whiting, occasionally, on the article.

Note—To make silver nitrate solution, dissolve in nitric acid 2 ounces of fine grain silver, observing the usual precautions against ebullition, and breathing of fumes. The precipitate formed is well washed in water until all trace of acid is removed, as determined by using litmus paper to test the rinsing water. Dry the precipitate in air, store in a dark bottle, well-corked as a precaution against deterioration.



A group of small components, plated and finished in colour



A vertical boiler with fittings and coal bunker coloured and plated

Glossary of Chemicals with Symbols

Alum, potassium aluminium sulphate.—K_2SO_4. $Al_2(SO_4)_3$. $24H_2O$.

Ammonia—NH_3.

Ammonium chloride, sal ammoniac.—NH_4Cl.

Argol, tartar, potassium hydrogen tartrate.

Caustic soda, sodium hydroxide.—NaOH.

Common salt, sodium chloride—NaCl.

Copper sulphate, blue vitriol.—$CuSO_4$. $5H_2O$.

Cream of tartar, potassium hydrogen tartrate.—$C_4O_6H_5K$. Obtained from argol.

Hypo, sodium thiosulphate.—$Na_2S_2O_3$. $5H_2O$.

Lead acetate, sugar of lead.—$(CH_3COO)_2Pb.3H_2O$.

Potassium ferricyanide.—$K_3Fe(CN)_6$.

Potassium permanganate, permanganate of potash.—$KMnO_4$.

Saltpetre, potassium nitrate.—KNO_3.

Silver nitrate, lunar caustic.—$AgNO_3$.

Vinegar, 3 to 6 per cent. acetic acid.—CH_3COOH.

Whiting, pulverised chalk, calcium carbonate.—$CaCO_3$. (or calcium sulphate, $CaSO_4$).

Acid, hydrochloric; spirits of salts.—HCl, 35-40 per cent. by weight when concentrated.

Acid, nitric, aquafortis.—HNO_3. Gives off nitrogen dioxide fumes, NO_2, when attacking metals.

Acid, sulphuric; oil of vitriol.—H_2SO_4. Sp.gr. 1.84 when concentrated.

The photographs reproduced with this article were taken and supplied by G. Barker of Huddersfield.

THE 1900 LOCOMOBILE STEAM CAR

(*Continued from page* 369)

the boiler without discomfort. Surely a most efficient heat extractor in about 14 in. of height.

Steering remains by tiller and the total weight of the car is 600 lb. The engine is $2\frac{1}{2}$ in. bore by 4 in. stroke, and consists of one main casting, the two cylinders with slide-valves between, cast-iron cylinder covers, and a light frame. The engine can easily be picked up in one hand, and the boiler coils weigh about the same. The engine was probably made in a small shop, and anybody with a good small lathe could build the entire engine.

Working pressure is 300 lb. per sq. in., but the r.p.m. are unknown. Stephenson link motion gives full speed in either direction instantly, as well as permitting very close control of the expansion.

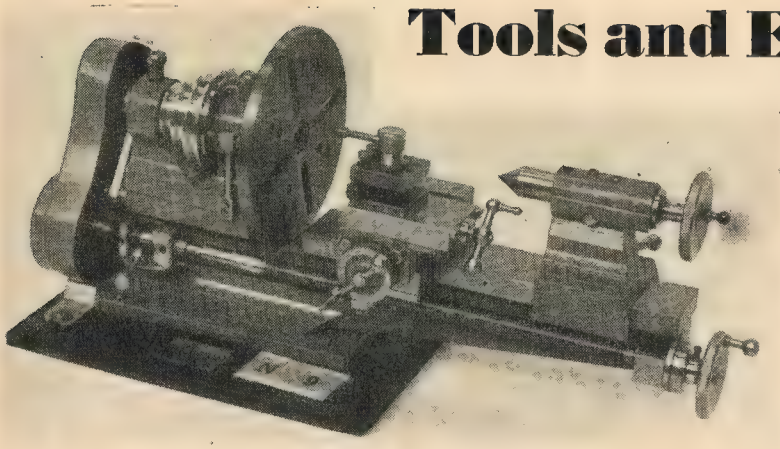
All in all, minor improvements only have changed this car from a museum-piece into a very great performer and a revelation to all who have seen it run.

The owner is not a steam man, being service manager for the Emerson Television and Radio Co., of San Francisco, and has only small home workshop facilities.

Any questions will be gladly answered.

Tools and Equipment at the "M.E." Exhibition

By E. T. Westbury



A 1½-in. centre lathe by Mr. T. E. Featherstone

ALTHOUGH the tools employed in model engineering are generally of a relatively simple character, a great deal of careful thought is devoted to their design and manufacture, both commercially and by the users themselves. The exhibits in this section of the "M.E." Exhibition are invariably interesting, and reflect the progress in workshop methods, particularly in the case of attachments and fixtures for the lathe and other machine tools; although the principles on which these operate have practically all been exploited long ago, new and improved designs are always forthcoming, and old, half-forgotten ideas revived and brought up-to-date.

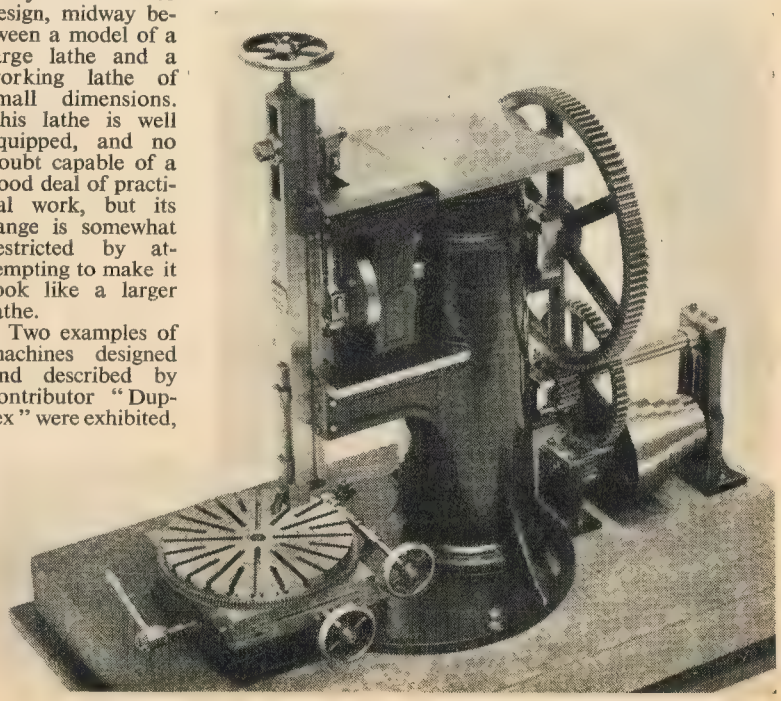
The examples of tools and appliances in the competition section of this year's Exhibition were not numerous, but they were widely varied and generally of high quality; the accent was on complete, special-purpose machines, rather than accessories. Three lathes were entered, all of entirely different types, the most striking being the 2½-in. precision lathe by Mr. C. W. Tidy, which although following the orthodox principles of design for this class of machine, yet managed to incorporate several improved details and novel features, besides being of a high order of workmanship throughout. The drive to this lathe is by an endless flat belt, on three-step cone pulleys, and a neat countershaft and motor mounting bench unit is fitted, with means of adjusting belt tension. An unusually long traverse to the tailstock barrel is provided, with a direct-reading scale in the front side of the barrel housing. *A very complete* set of accessories was shown with the lathe, including a milling spindle with pre-loaded ball-bearings, adapted from the cutter head design of the "Duplex" engraver.

The combined lathe and drilling machine by Mr. P. Gates is a very small and compact device intended for watchmaking, and no doubt capable of useful work in this capacity. It can be mounted either in a horizontal or vertical position for adapting it to its respective purposes, and can be fitted with either a hand turning rest and the usual centres, or with a tailstock drill pad, a sensitive lever feed being provided to the tailstock for drilling. Standard split collets are employed in the mandrel, but the drawbar which operates them is of unusual design, in that it is keyed against rotation in the mandrel bore, and the handwheel screws on to draw in the collet.

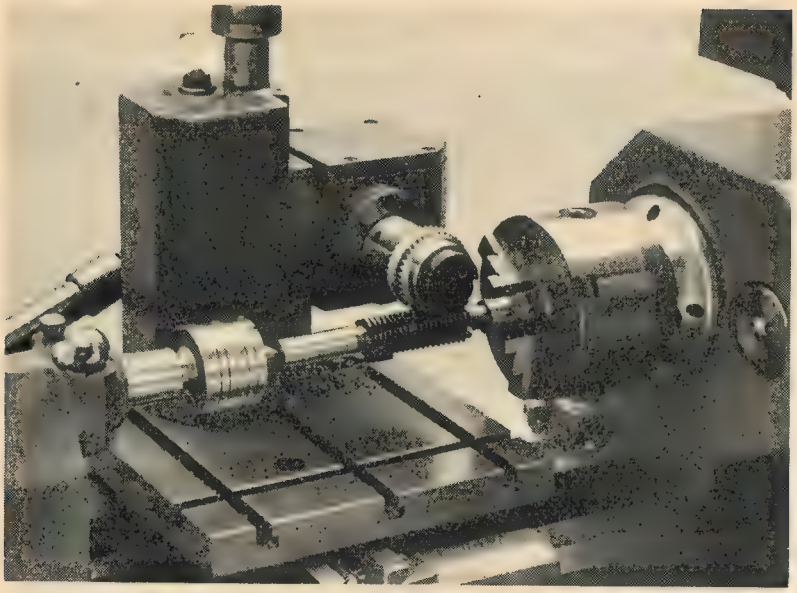
In the 1½-in. lathe by Mr. T. E. Featherstone we have an example of the type of machine often built by model engineers, which might be described as a hybrid form of design, midway between a model of a large lathe and a working lathe of small dimensions. This lathe is well equipped, and no doubt capable of a good deal of practical work, but its range is somewhat restricted by attempting to make it look like a larger lathe.

Two examples of machines designed and described by contributor "Duplex" were exhibited, namely the jigsaw machine by Mr. A. Ashby and the engraving machine by F. G. Bettles. Both incorporated certain minor modifications, but were true to the essential character of the design and contained a great deal of well-executed detail work. As these machines have been fully described in THE MODEL ENGINEER, it is not necessary to give further particulars of them here.

One exhibit which was entered in the general engineering section, but which will be of interest to all who study machine tool design, was the scale model of a Shanks vertical shaping and slotting machine, by Mr. L. J. Roe. This was an excellent representative example of the type of machine tool which was in use a century ago, the date of the original prototype being



The 15/32-in. scale model of a Shanks shaping and slotting machine (1848) by Mr. L. J. Roe



The Boxford hobbing attachment in use, making 40-toothed worm wheels for dividing attachment

given as 1848. It very clearly shows that the essential principles of machine tools have altered very little since that time, and apart from more compact and massive construction, to enable higher power to be applied to advantage, the most noticeable difference in modern machines is the complete enclosure of all gearing and most other working parts. This, of course, is a necessity under present-day factory regulations.

One point about the model which was questioned was the method of operating the feed-screw of the cross-slide, by means of a lever, the boss of which was internally splined to fit over a rigidly attached member on the screw. It was thus equivalent to a socket spanner, and had to be completely removed and re-engaged for each half-turn of movement; the general idea was that some form of ratchet device would have been used, in the absence of a handwheel such as fitted to the lateral and rotary table feeds. However, the rest of the details, and general proportions, indicated that careful attention had been paid to producing a faithful copy of the original, and the workmanship, including fabrication of components, and finish were of a very high order.

Several examples of the Turpin dividing head have been seen at recent exhibitions, and the continued popularity of this device was shown in the example by Mr. R. S. Shute. Of the simpler items of equipment, such as the compound slide-rest by Mr. A. E. Kerswell, the screwcutting indicator by Mr. V. Jones, and the 0-1 in. micrometer by Mr. P. J. Risley, it need only be said that these were well-made devices, which will no doubt give good service in the workshop.

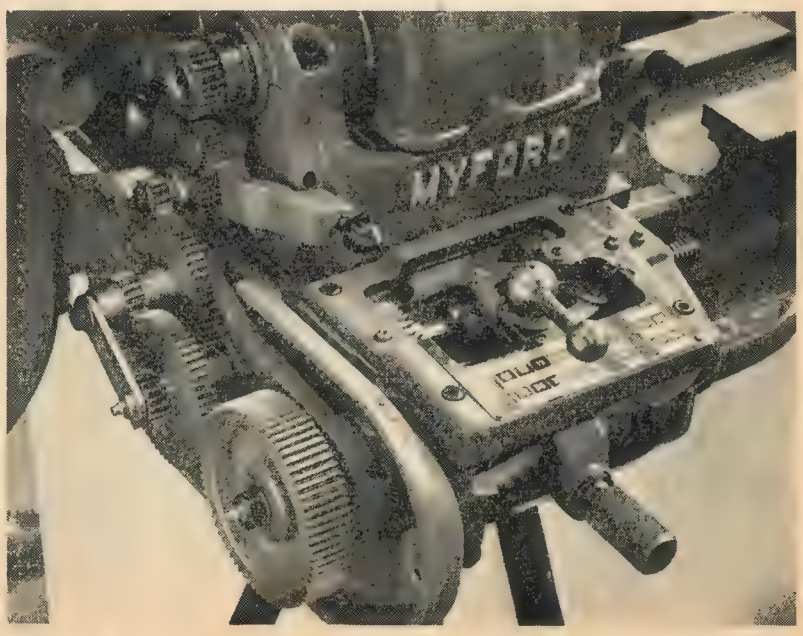
A number of very practical workshop tools were entered in the Students' Cup competition, including scribing blocks, machine vices, clamps, etc.

Trade Exhibits

Perhaps the most outstanding modern development in this department is the small electric-powered hand tool, and its adaptation to a wide variety of machine operations. No less than three manufacturers specialising in tools of this type were represented at the exhibition, and their demonstrations were a perpetual centre of interest. It is hardly necessary to remind readers of the ways in which these tools can be converted to lathes, drilling machines, circular saws, fretsaws, etc., by means of simple accessory fixtures, and neither would it be prudent to draw invidious distinctions between their respective merits and versatility. It may, however, be observed that the latest addition to this range of tools, namely the Toolpower general-purpose drill, by Messrs. S. N. Bridges & Co. Ltd., is claimed to have an exceptionally powerful motor, and tests made in the hands of both demonstrators and visitors seemed to substantiate this. The manufacturers have also hit on the bright idea of extending the application of the tool to domestic purposes, such as floor polishing, and it is more than likely that many a model engineer will find a pretext for obtaining one on the strength of this—but whether he will ever be able to obtain the use of it in his workshop is another matter !

For readers who prefer to make up their own simple machine tools, the "Picador" fittings, such as featured on the stand of Messrs. Bold and Burrows, offer attractive possibilities; they include brackets and plummer blocks with self-lubricating bushes, which can be used to make up not only lineshafts and countershafts, but also wood-turning lathes, circular saws, grinding and polishing heads, etc., in conjunction with a wide range of pulleys and other accessory fittings.

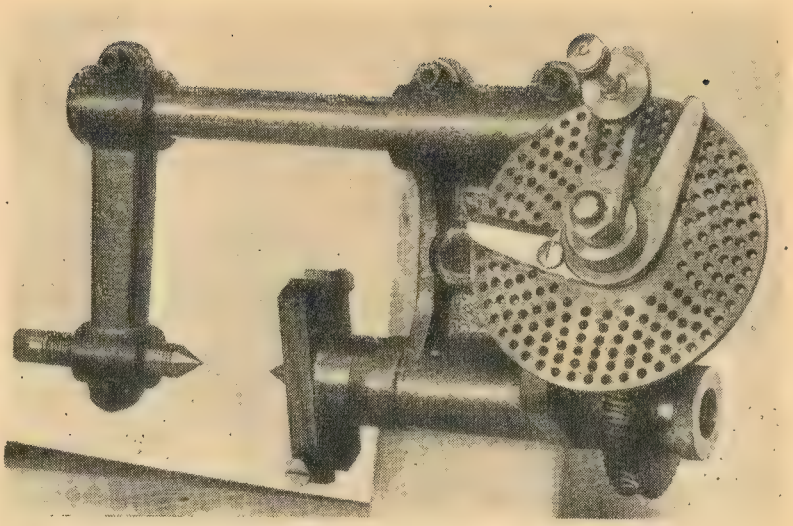
The machine tools featured on several stands are all well known to model engineers, having been advertised and



A part-sectioned specimen of the new Myford screwcutting gearbox

reviewed in these columns. No entirely new lathes made their appearance this year, but there were several new accessories and attachments shown for the first time. Messrs. Denfords Engineering Co. Ltd. demonstrated, in conjunction with the well-known Boxford lathes, an interesting hobbing attachment for the quick and accurate generating of worm wheels. The blank is carried on a horizontal mandrel running in bearings, on a vertical-slide which provides feed movement for depth of tooth and it is positively rotated, at a rate to suit the pitch of the teeth, by a universally-jointed shaft deriving its motion from the lathe screwcutting gears, by way of additional gearing at the tail-end of the leadscrew. Attachments working on similar principles, but varying in details, have been described in THE MODEL ENGINEER. A similar vertical-slide fixture is used to carry a worm dividing attachment for cutting spur gears or similar purposes; the photograph of the hobbing device shows a worm wheel for the latter in the process of being hobbed. Boxford lathes can now be obtained with Norton type screwcutting gearboxes, and a large tee-slotted table is available as an alternative to the normal cross-slide for carrying fixtures or for saddle boring operations.

The Myford Engineering Co. Ltd., who rarely fail to pull something new and interesting "out of the bag" each year, showed for the first time their new screwcutting gearbox, designed to fit the M.L.7 and Super 7 lathes, either in new machines or as an attachment to existing ones. This component, as I happen to know, has been evolved after long and patient experimental work, not so much into working principles, which are already well established, as in detail design and methods of production, to enable it to be produced economically without detracting from quality and usefulness. It is not yet in production, but as soon as it is, we hope to give a more detailed description of it in THE MODEL ENGINEER.



A new dividing attachment by the Winchester Engineering Co.

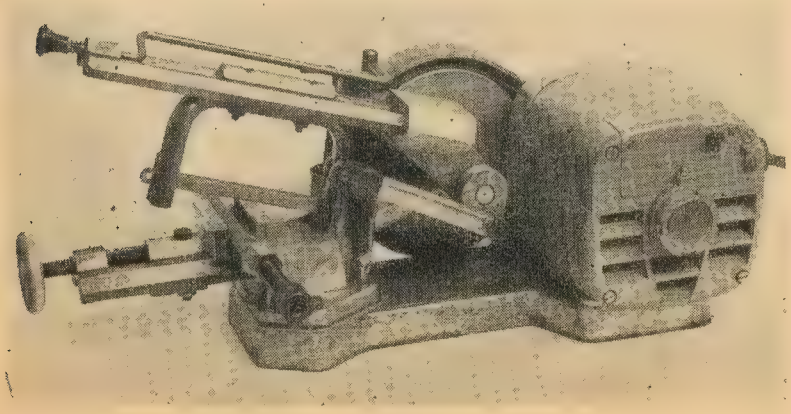
A useful and relatively inexpensive dividing attachment was introduced this year by the Winchester Engineering Co., a newcomer to the Exhibition whose products we hope to see more of in the future. This is made in two forms, one being a fixture for the milling machine, serving as a simple but complete and practical dividing head, and the other as an attachment to be carried on the vertical-slide of the lathe; in each case, castings and certain finished parts are available to constructors. This device does not incorporate any new principles, but it appears to be neatly designed, and will be useful to both amateur and professional engineers.

Wilmac Products exhibited woodworking machines and components for constructing them, including circular saws and bandsaws.

Among the smaller workshop appliances, those demonstrated by Messrs. W. Kennedy Ltd., namely, the Kennedy bending appliances and miniature power hacksaws, deserve special attention. The former have been shown at a previous "M.E." Exhibition, and both items have been reviewed in these columns, so they will be familiar to most readers; their ingenuity, usefulness, and economy, both in space occupied and initial cost, will earn them a place in many small amateur and professional workshops.

Messrs. Kennion Bros. (Hertford) Ltd., apart from their usual specialities, this year showed a set of castings for a ¼-in. capacity sensitive drill. The well-known "Reliance" drill grinding jig and other items of equipment were again demonstrated by Messrs. H. D. Murray Ltd. Drills and cutting appliances for masonry and other hard materials, together with plugs and cements for fixing in these materials, were demonstrated by Philplug Products Ltd., and Mason Master Ltd. Among cutting tools, the products of Spiral Saws Ltd., for application to both hand and machine tools, were effectively demonstrated, and the well-tried Abrafiles, for use either in tension frames, or as hand files in larger diameters, were shown on the stand of Multicraft Ltd., together with the Multicraft cutting tools, of special interest to constructors of aircraft or ship models, or marquetry workers. The simple and inexpensive, yet highly effective, paint sprays by Sprayt, shown for the first time, will undoubtedly help many model engineers to solve the difficult problem of finishing their models neatly, and without obscuring detail work.

This does not by any means exhaust the list of interesting items of equipment to be seen at the Exhibition, but will, it is hoped, convey to readers the impression that exhibitors in this section are certainly not letting the grass grow under their feet.



The Kennedy high-speed hacksaw machine

A SUPERCHARGED VEE TWIN

DETAILS OF AN EXPERIMENTAL 15 cc. ENGINE FOR A RACING HYDROPLANE

By B. Statham

THE valve operating mechanism is usually somewhat complicated with a vee twin, so it was thought desirable to simplify things. As has been stated, a single camshaft is used, and as the inlet valves stand vertical, simple beam rockers fill the bill so far as the inlets are concerned, In the case of the exhausts, overhung rockers of the usual o.h.v. type were built up by brazing. The push-rods are light alloy knitting needles (or parts of knitting needles) with hardened steel end caps. The tappets are flat-topped, and work in long dural guides.

The Supercharger

When it came to the design of this component, the writer was in the limbo of the lost, with no past experience to draw on, and many, many hours were spent trying to think this out.

Had the writer passed on to a better land about that time, without a doubt the word supercharger would have been written on his heart. Every printed word on the subject that could be found was read over and over again, and that was little enough, in all conscience. The description of Mr. Chaddock's " Zoller " was read and re-read many times, and several other types of controlled-valve blowers came up for thought. In the end, rightly or wrongly, it was decided that in such a small size it could easily be that tiny free blades of thin Tufnol would put up less friction by pressing in the liner than would be put up by mechanism to control the vanes. It was also thought that free vanes would have two added advantages: one, that there would be less leakage past the vanes at high speed, and two, that since the vanes would not be out until quite a high speed was reached, it should be possible to start the engine on a nice low compression ratio, aspirated. For once in a while, things have worked out according to plan, and after two seasons' running, the blower liner is just nicely polished and there is no trace of wear anywhere; furthermore, in use, the vanes come out at just about the right time (for a four-stroke, that is). It may interest two-stroke fans to know that a lusty pull on a starting cord will build up a pressure of 6 p.s.i. in the transfer pipe.

In designing the blower, it was desired to obtain a boost pressure of one atmosphere, but how to calculate the length the blower had to be to obtain this was a different story. The bore was settled by the possession of a piece of stainless-steel tube of $1\frac{7}{8}$-in. bore, ground inside and out. In all these ponderings, the writer was greatly aided by a fellow hydroplane fan, Dr. Hewlett. In the end, to obtain some idea of displacement, a tin tray was soldered up, the exact size of half one of the crescents between the rotor and liner, and 1 cm. deep. This tray was filled with spirit and then emptied with a metric hypodermic syringe; the finding was multiplied by four, and by this method it appeared that a length of $\frac{13}{16}$ in. would give a displacement of 15 c.c., so this was settled on. It has become evident that we underestimated the displacement a little, for the boost pressure (in the original transfer pipe) went up to 28 p.s.i. What the mean pressure was is not known. All in all, the blower has turned out to be one of the successful components.

The Transfer System

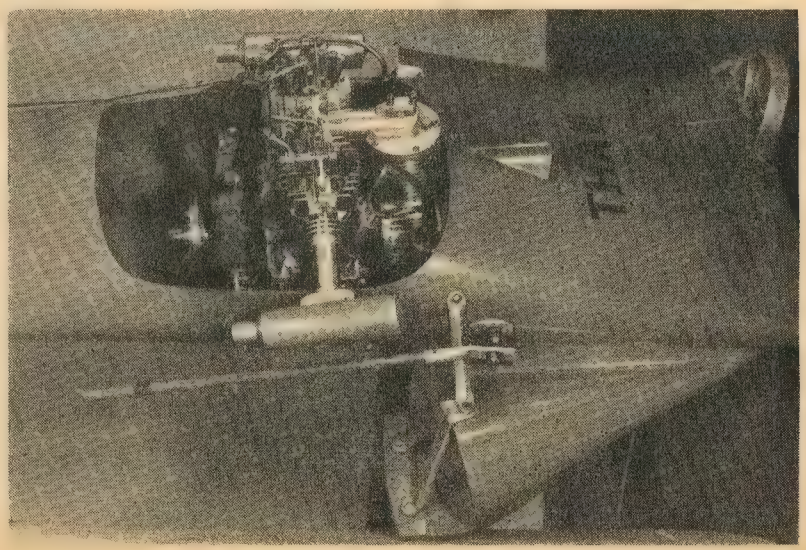
As first built, a transfer pipe of $\frac{5}{8}$-in. copper tube was used. This, together with the T-piece between the cylinders, and space above the rotor in the blower, added up to a capacity of some 9 c.c. It was considered at the time that this would provide an adequate storage capacity; however, during the first season's running, it was noticed that according to how the rotor was timed, one cylinder or the other was receiving a heavier charge. Therefore, at the end of the first season's running, a really large storage chamber was made; this has a capacity of some 40 c.c., and was responsible for a really great improvement in running. Starting became much easier, and the engine became generally much easier to handle. All joints from blower to cylinders are in the form of stubs and sleeves; the stubs are grooved, and the grooves are packed with graphited yarn, steam engine piston fashion, to allow them to turn and slide about without leaking.

Carburation

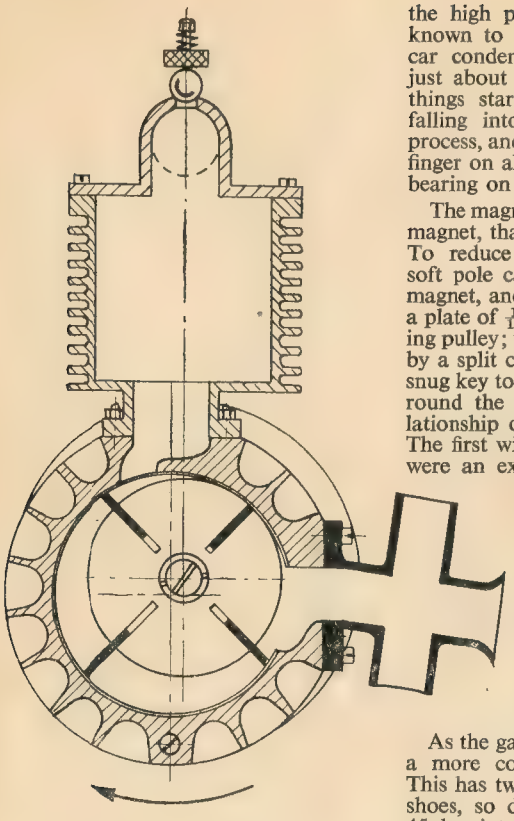
In its short life, the engine has had four carburettors, but it is only necessary to mention two, the first and the last. The first, to give reasons why it was discarded, and the last to give reasons for liking it.

The first was of a well-known type, with a barrel throttle, and the jet feeding into the axis of the throttle. As a carburettor, this worked very well, but in chawing it out from the solid, the builder's sense of proportion had gone a bit astray. The body was rather long, and the throttle barrel and a rather heavy safety device were at the remote end. It was found that at high revs, the fuel was frothed up in the pipe, causing uneven running, due to the end of the long carburettor flapping about. As an experiment, a very short and light one was made that cured the frothing trouble; this had no throttle, nor had the simple one that followed it, and as it was found that the engine was un-

Continued from page 343, *September 16th*, 1954.



Engine in hull, viewed from above



End view of blower and receiver

manageable with just an air shutter, there was nothing for it but to try to produce a decent carburettor. This called for more head-scratching, in trying to decide what kind of thing to make. In looking back some 20 years, it was realised that about the only type that had never been tried was the most obvious type of the lot, the sliding barrel, tapered needle, motor-cycle outfit.

Just by way of a change, this new instrument was built up with brass tube and Easy-Flo, and, after a few adjustments, has proved to be the most satisfactory carburettor the writer has so far produced; the engine can really be controlled, from a tick-over to flat out. Automatic compensation is not so hot in getting the boat away, but then the writer has never been able to build one that was so hot as that.

Ignition

That word spells the rock on which the engine nearly split. In designing the engine, ignition was not taken very seriously: it was felt that would just fall into place. It was realised that ¼-in. sparking-plugs with very short leakage paths were likely to be troublesome, but it was *not* realised *how* troublesome they, and sparks in general, could be when asked to fire very dense charges. Several plugs have blown to bits under the high pressures. For reasons best known to themselves, certain types of car condensers have packed up, and just about everything happened before things started to fall into line. The falling into line has been a gradual process, and it would be difficult to put a finger on all the things that have had a bearing on the matter.

The magneto uses a four-pole Scintilla magnet, that also serves as the flywheel. To reduce diameter and weight, the soft pole caps were removed from the magnet, and it was sandwiched between a plate of $\frac{1}{16}$-in. dural and a dural starting pulley; the fixing to the crankshaft is by a split collet, and a $\frac{1}{16}$-in. soft alloy snug key to prevent the magnet creeping round the shaft and upsetting the relationship of poles and contact breaks. The first winding and set of pole shoes were an experiment; perhaps a better word would be "gamble." It was realised that to expect sparks at 45 deg. intervals from a 90 deg. magnet running at engine speed was a rather tall order, but, having known even odder things to happen with magnetos, it was decided to try it out, and the gamble nearly came off, as will be detailed later.

As the gamble did not *quite* come off, a more complex magneto was built. This has two coils and two sets of pole shoes, so disposed as to line up at a 45 deg. interval: this arrangement called for two sets of contacts, and two condensers, so that in effect each cylinder has its own magneto system. As time was pressing, lightweight Villiers coils were used. As might be expected, there was a good deal of interaction between the complicated pole arrangement that had an adverse effect on the sparks, and before two satisfactory sparks could be obtained it was necessary to make several cams to obtain the best amount of dwell. In the end, patience was rewarded, and two sparks of $\frac{3}{8}$ in. in air were obtained. Here endeth the easy part.

We have had the trials; now for the tribulations. By the autumn of 1951, the engine was finished, with the exception of the oil pump and some carburettor parts. In this form, it was shown at the "M.E." Exhibition and was smiled upon by the judges to the tune of a Bronze Medal. On its return, the need was felt to extract a bang or two from it, as some compensation for the headaches, and as an earnest of what it was hoped was to come. Whilst the engine was still mounted on its show base, a small carburettor from a compression-ignition engine was stuffed into the main choke tube, some fuel was laid on, and "string-pulling" started. After a few pulls the engine tore off a fast strip that provided quite a lot of compensation.

String-pulling had loosened things up, so it was decided to call it a day, and finish the job before having any more runs. As work went on with the oil pump, it became evident that it was quite out of the question to finish the engine and build a hull in time for the 1952 season, so once again Dr. Hewlett stepped into the breach and undertook to build a hull; as a result, it was possible to spend rather more time on the engine than would otherwise have been possible. When the oil pump and carburettor were finished, the engine was mounted on a board, and an old hair drier fixed up to blow cold air on the cylinders. The engine started easily on a cracked throttle, and was run slowly for a time; after a time the throttle was snatched open for a second, and the resultant roar was most gratifying.

All this was *much* too easy, and the snags were awaited; they came a-plenty, but whilst things were in this easy stage, one most pleasing thing was noted. The engine was screwed down to a bench that was littered with tools, and as the engine ran at any speed, the tools just stayed put. That was a distinct change from any engine that had been run on that bench before, when any tools on the bench to start with had soon been on the floor.

A few more runs were made, and it was noticed that each time starting became more difficult; also, it became impossible to open the throttle at all. The engine cut, as if switched off, if the throttle was moved from the starting position. The jet and plugs were cleaned, with no improvement; on the contrary, things got worse. These tests were being made with a 50-50 petrol-benzole mixture and rather hard plugs. At the next attempt a pair of very soft plugs with very thin electrodes were tried. With these, an easy start was made, and for a few runs everything was all right, then starting went off again. It was pretty plain that sparks were failing, so the magnet was re-magnetised. This gave a dozen good starts and a few difficult ones. At this, it was decided to waste no more time with this magneto since it was pretty plain that the reserve spark efficiency was quite inadequate; the gamble had not quite come off. The twin-spark coil and single pair of pole shoes were removed, and the magneto described earlier was built and fitted; this behaved much better, and further runs were made. All this time the hard plugs were a perfect nuisance; if a start was not made in two or three pulls, the plugs had to come out for cleaning. It was found impossible to use the soft plugs, for the high cylinder pressures simply blew the insulators out. Whilst on the subject of cylinder pressure, at this stage no boost pressure gauge was available, but it was plain that there was a pressure, and not a depression, for a slight leak was blowing oil *out*. By this time Dr. Hewlett had a hull ready, so the skeg and the rest of the fittings were made, and the engine fitted.

When this was done, the next thing

was to try a run round the pole, which called for teamwork, and two colleagues, Dr. Hewlett and Mr. Chapman, responded nobly; it would be true to say that without their help, very little progress would have been made. On the first outing, the engine started easily, and after launching, ran a few yards, then slowly came to a stop. Several attempts were made, and each time the same thing happened, so we called it a day. It was thought that since air was flowing into the blower all the way round the clock, the depression at the jet at slow engine speeds was not likely to be very fierce with a $\frac{1}{4}$ in. choke tube, so before another outing the choke was reduced to $\frac{3}{16}$ in. For good measure, the fuel tank was also lifted so as to provide a positive head of fuel to the jet.

At the next outing, things were slightly better, but still the engine petered out each time after a few yards. There were now signs of what appeared to be detonation, so the boost pressure was reduced by spilling some of the charge from the transfer pipe.

At this, there was a slight improvement in running, but such a reduction of power that experiments on those lines were dropped.

At the next outing, a 50-50 benzole-methanol fuel was tried, but this outing was so marred by plug trouble that nothing was learned. And so it went on; nothing seemed to make the slightest difference, until one day, the engine stopped with a bang and a broken crankshaft. This crankshaft was made of high tensile steel, and it was wondered if the heat of brazing had upset the steel, so one was made of good quality mild-steel.

This shaft was fitted the day before the Wicksteed regatta, and to provide an excuse to watch other people's boats run, the boat was taken along. There *was*, also, a vague hope that after our little 60-yd. pond, the sight of such a nice expanse of water would inspire it to run. But alas, they were false hopes; the boat plugged round for a few laps like a not very good tug, and so the season went on, with plug troubles and detonation and *no* run worthy of the name round the pole.

To celebrate the last run (?) of the season, the crankshaft broke again, so before anything more was done, we settled down to some armchair work, to try and think up what was wrong. In the end, the large storage chamber was made and fitted, and things opened up in the crankcase to take a 1 in. ball-race, $\frac{1}{2}$ in. bore, and a new shaft $\frac{1}{2}$ in. diameter, was made and fitted. To round matters off, a new carburettor was made, the sliding plunger type mentioned under the heading, "Carburation." When these little jobs were finished, the engine was salted down in a box for the winter without another run.

By this time, Dr. Hewlett was progressing with his new blown engine, and it looked as if he would be wanting a hull, so the writer got to thinking about a hull for himself. Since the complete power unit now weighed $6\frac{1}{2}$ lb., the weight of the projected hull was of some importance, and it was thought that to produce a *really* light hull it would be necessary to break away from accepted practice a bit. The result of those thoughts was a hull folded up, and rolled from one sheet of 1-mm. ply-wood, by methods that would have made a joiner weep many bitter tears. By putting the prop through the transome, and keeping all the trimmings as light as possible, the complete boat in running trim weighed just over $8\frac{1}{4}$ lb. All this was done in good time for an early start in the season; but for one reason and another, it was impossible to make a start before August.

When the engine was run for the first time with the modifications referred to, a fuel of 80-20 methanol-benzole was used, and Castrol R was used for lubrication. It soon became plain that the large storage chamber, and the new carburettor, had made a vast improvement in engine efficiency and general handling; in fact, the outlook seemed most promising, and the boat was hooked to the line in high hopes.

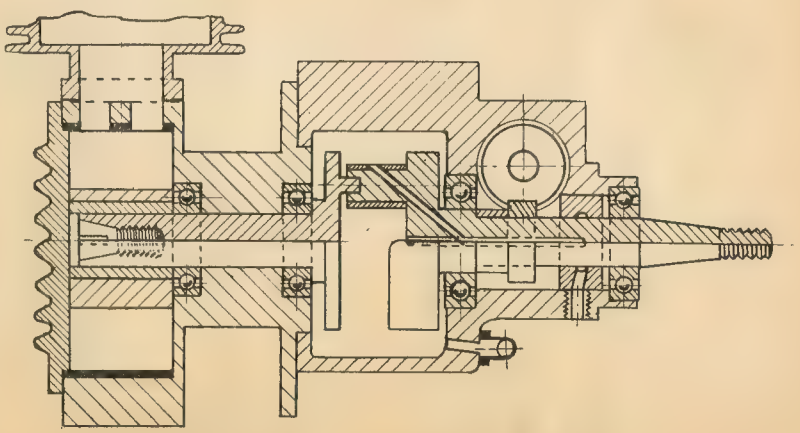
These hopes were soon to fall, for now no power on earth would persuade the thing to run anyhow at all. At the slightest provocation it would drop on to one cylinder, and if perchance it *did* run on both cylinders for a few moments, all that would be soon altered on launching the boat. Result of outing—No run.

Three or four more outings were made with similar results. The engine would start and run perfectly at home, but at the pondside things soon went haywire. Somehow the first launch always got muffed, and from then on things were quite hopeless. Always, the next day at home the engine ran perfectly.

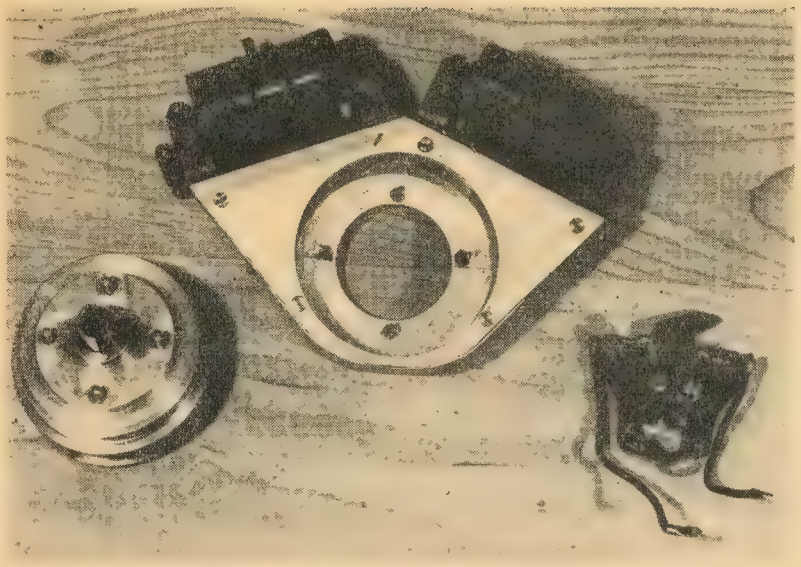
Things were in this happy (?) state when the date of the Grand Regatta came along, and it was felt that it would be pleasant to see a boat run even if not one's own; and that is how things came to pass. A most enjoyable day was spent watching boats that *would* run. With *THA III* the expected fiasco duly came to pass. During the day, in little chats with fellow speed fiends, useful suggestions were received and duly noted.

For the next outing at home, straight methanol was used, as with any benzole at all in the fuel, there seemed to be signs of detonation. Starting proved to be quite good, and for once a good launch was made early in the proceedings. For the first time the engine really got going when water-borne and for a few brief moments the boat started to really move, but that was all; it dropped on to one cylinder, and proceedings were over for the day. Two more outings were made, with the same results; a short, fast run and then all haywire. After this, in disgust, instead of waiting till next day before testing components, the ignition was gone over on reaching home, and it was found that one of the condensers was faulty; its insulation resistance was nil. This was the condenser that served No. 1 cylinder, the one that had been so tricky for so long. This condenser was laid aside, and the next day tested again; it now appeared as good as it had ever been and would hold a charge for a minute, but after passing it quickly once through the flame of a bunsen it was tested again and was faulty. It now appeared plain that this faulty condenser had been playing tricks throughout almost the whole life of the engine, and confusing things that were confusing enough in all conscience without that.

The next time out, after a few false starts, a really good run of 8 laps was made at quite a high speed; no watch was at hand, so the speed is not known, but it was nothing to sneeze at. The main difficulty was now launching; the writer is not good at this even with an easy boat, and *THA III* is definitely not one of the easy ones. To impose some



Longitudinal section of crankcase and rotary blower



The magneto components : rotor, stator and contact-breaker

load on the engine, it is necessary to use a very big prop; the latest is 3⅞ in. diameter, 9 in. pitch and 2¼ sq. in. total area, and when the boat is up on its toes, one cylinder will drive it, but it is most difficult to get away. If the boat is not launched really fast, it will just stand still with the engine roaring. At last the inevitable happened, and the boat was launched all the same like a submarine. As the weather was now growing chilly, that was that for the season of 1951.

During the winter it is hoped to do something about launching. In any event, although no doubt there are more bugs to be winkled out of the engine, the writer is expecting, circumstances permitting, to get in some good runs during 1954. And even, maybe, sniff at the heels of the redoubtable two-strokes !

At first glance, it may appear a little odd that an article on an engine should be concluded with a written description of a hull. But, with the editor's permission, the intention is to do just that.

A brief reference has been made to the hull that houses the engine described, but it is felt that it may have some points of interest in its own right. As has been stated, the power plant, complete, weighs 6⅛ lb. so it was obvious that if the total weight of the boat was to be kept in reason, the hull would have to be unusually light. There seemed little chance of building a hull on orthodox lines that would be light enough, so other methods were brought up for thought. As a result, a lot of experiments were made with bits of cardboard and glue, and some quite shapely little hulls were produced by wrapping. It was found that although ply-wood cannot be bent two ways, if it was folded one way and put under strain the other, the resulting hull was very stiff. At last a design was settled on, and the fun commenced. The hull was to be 34 in. long and in the form of a tube aft of the engine, tapered from 7½ in. at the engine to 4 in. at the transom, and forward of the engine, brought down to a horizontal knife edge. The first job was to draw out the shape that would give what was wanted when folded on a sheet of 1 mm. ply. This was then rolled into the form of a tube with the edges butting, and on the underside an inch wide strip of ply was glued with waterproof glue. This lot was held in place, whilst the glue set, with bits of angle iron, curtain rod, cramps, sundry weights and bits wonderful to behold. After a couple of days the sundries were removed to reveal a surprisingly stiff tube. The bows were then squashed down on to a ⅜-in. strip of hardwood and glued there. The main part of the hull was finished and weighed 12 oz. only.

The sponsons are simply ply, folded in the form of cones, and screwed and glued to the hull. A pair of soles of 2 mm. ply were fixed to the bottom of the sponsons for the boat to run on, and the hull was built; total weight, 20 oz. The transmission, tethering points, and trimmings were kept as light as possible, and things ended up with the boat weighing in running order 8¼ lb. Doubtless, Noah built a boat by this method when he was a little boy, and the writer is merely putting the idea forward as a method of building a light hull that is strong and simple to build (a most important point, that last, to a wood-work hater!). The photographs will give a fair idea of the shape a-beam and as seen by the stickleback. If one starts to build a boat by this method, one should have an open mind as to the *exact* shape the hull is to be, for plywood appears to have a will of its own !

Appendix

Since the writings of the article, and during the preparation of some drawings of sorts, rather a lot of "tempus" has "fugited" and the 1954 season is well past its zenith.

The boat has been taken to the pond a few times, and each time has performed very well indeed, getting in runs of from 8-18 laps at speeds of 50-60 m.p.h. The engine is still somewhat coy in the presence of strangers, but it is hoped that one day it may be possible to creep up on it unawares and trick it into behaving at a regatta. In any event, it is now possible to say that the engine is successful; doubtless, it will always be somewhat temperamental, for although there are no superfluous bits in it, none the less it is rather a box of tricks; but it has been, and still is, a fascinating thing to wrestle with.

If one may give an opinion on such a short acquaintance with blowing, it is: The toughest problem connected with blowing an engine is the problem of ignition; with very dense cylinder charges, full scale sparks are needed, and these are difficult to cope with in tiny oily sparking-plugs. It seems hardly likely that glow-plugs would provide the complete answer. For one thing, the effective compression ratio of a four-stroke varies a great deal, from very low at starting to very high when the blower is doing its stuff. This reminds the writer of a point missed in the text and that is: From experiments made, it would appear that small advantage is gained from moderate boosts of 6-8 p.s.i. To obtain *real* benefit, a boost in the order of two atmospheres seems to be needed; that really does make things happen !

Next Week . . .

EXHIBITION REVIEWS

Comments on the models in the locomotive and traction engine sections of the "M.E." Exhibition, by J. N. Maskelyne and W. J. Hughes, respectively.

TEMPUS FUGIT !

"L.B.S.C.", in another popular Lobby Chat, discourses on the flight of time, and the changes it brings.

THE GRAND REGATTA

The Model Power Boat Association's star event reported by "Meridian," with illustrations of some of the large number of boats which took part.

STEAM TURBINES

The conclusion of the series of articles on a simple geared impulse turbine, by E. T. Westbury.

A COMPRESSOR UNIT

"Duplex" deals with the construction of a small and compact vee twin air compressor, with its motor drive.

READERS' LETTERS

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

SOLID-FIRED MARINE BOILERS

DEAR SIR,—I was rather surprised at the apparent lack of information about solid-fuel boilers for ship models expressed in Mr. Westbury's recent, and as usual intensely interesting article.

I have limited experience in working ship (prototype) models, but a solid-fuel boiler of "annular" type has proved most successful in a 54-in. tug model, now being completed.

The boiler, which was brazed up for me, is based on a design given about five years ago in THE MODEL ENGINEER, which was made up in steel, welded, with a conical firebox. This design was, I believe, taken from a model "Sentinel" boiler, in THE MODEL ENGINEER about 1912. Hence there is nothing very new about this type.

The main considerations appeared to me to be (*a*) accessibility of firing up; (*b*) adequate draught under normal conditions; and (*c*) simplicity of steam raising.

An extension "door" on top of boiler satisfies (*a*). This comes to boat deck level. (*b*) This is taken care of by ¼ in. exhaust from engine trap ("condenser"), which is internally threaded at exit in chimney base to allow various sizes of blast nipples to be screwed in—my final size being No. 38 drill. This, of course, is quite arbitrary and depends on the type of engine, exhaust pressure and other factors.

The live steam blower is fed from an external steam turret (light superheat from half a turn in smokebox), and is of 3/32-in. pipe hammered down at the end to a pin hole (about No. 70 drill).

This proved a workable arrangement, with anthracite (pea size) and plenty of footwork on a motor-type pump. This gruelling performance, however, takes about 15 minutes to raise pressure from cold.

(*c*) However, not wishing to emulate a monkey on a pogo stick in public, I cribbed Mr. V. Harrison's idea of a small auxiliary boiler to raise steam, and this has worked wonderfully well, in conjunction with a change of fuel to "Coalite," which leaves no clinker, makes a free fire, lights easily and is smokeless.

This vertical "pot" boiler is just a 20 G. copper sheet rolled up to 2⅜ in. diameter by 6 in. high with an internal centre flue 1¼ in. diameter, carrying six ⅜-in. cross tubes—like a normal centreflue boiler stood on end. The boiler carries filler screw and one screw-down valve only—quite safe, as long as you make sure valve is *open* when in use!—the steam pipe enters main blower pipe in a T-piece *beyond* live blower valve.

The procedure is as follows:—

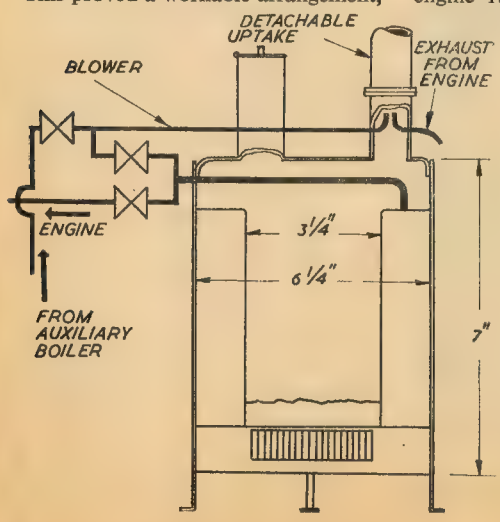
(1) Light 3-wick spirit burner (or Meta) open auxiliary boiler valve. Close main blower valve. Steam blowing up main boiler uptake in 3½ minutes.

(2) Drop in wood soaked in meths. in main boiler and open firehole door to stop wood flames from roaring up flue. (3 minutes.)

(3) Add "Coalite" to 1½-in. deep fire. Steam raised in 5-6 minutes.

(4) Extinguish auxiliary boiler lamp, *close* valve on this boiler and *open* main blower, which takes over.

Total time from lighting pilot to engine running is 12-13 minutes and *no* hard work!



"Coalite" will keep alight for some 10 minutes, with *no* draught other than natural, and I believe this fuel to be largely responsible for the ease of manipulation of plant.

So far the boat has had but two outside tests in a nearby pond, but plenty of running in a tin bath in a garden; it is felt, however, that the model can now be completed with considerable confidence that the plant is a practical worker.

The subject of water and oil supply, speed of engine and steam pressure of the plant, also type of engine (⅞ in. by 1 in. D.A.S.V.) is too large to mention here, but all these matters must be taken into consideration to give a balanced effect in the machinery as a whole. The longest run so far has been four hours in steam, and the fire was only cleared once with a few prods of a steel knitting needle.

Yours faithfully,

King's Lynn. ANTHONY BEAUMONT.

ELECTRIC WELDING PLANT

DEAR SIR,—In "Readers' Letters" in the June 10th issue, Mr. James M. Bruce of Angus, wrote of a dynamo he is using in his home-made welding plant. I wonder if he could let me know the serial number and place of purchase?

For readers who are interested in transformers for welding, they might like to know about the one I am using. It is an ex-Government surplus transformer, with an output of 4, 6 and 11 V, at 200 amps. It was rewound with 80 turns of 12 gauge DCC copper wire, and it will put down a 12-gauge welding rod quite easily. The main thing to remember is not to use it for longer than ½ hour at a time, owing to the heat generated.

I hope other readers will find this useful.

Yours faithfully,

Bristol. H. F. HORMAN.

MOWING WITHOUT BLOWING

DEAR SIR,—About 12 months ago I fitted a ¼-h.p. electric motor to my lawn mower (a "Green" about 40 years old) on the lines set out by D. C. Morton in the issue of THE MODEL ENGINEER, dated July 19th, 1951.

The motor is hardly powerful enough to drive the roller, and in use I have disconnected the second belt, leaving the motor to drive the cutters whilst I do the pushing. Even so, it has certainly removed the "blowing" (twice a week) as far as I am concerned, and it is entirely satisfactory.

I should like to thank Mr. Morton for his tip, and he may be interested to know that I have only cut the cable once!

Now I am flirting with the idea of an electrical hedge cutter (THE MODEL ENGINEER article of January 19th, 1950, by E. F. Scott), and intend to have a shot at this, and so remove the work from the second laborious task in my garden.

Would someone, then, design an electrical digger and a weeder?

Yours faithfully,

Birmingham. WILF H. KESTERTON.

WITH THE CLUBS

The Society of Model and Experimental Engineers

On Saturday, September 25th, 1954, at 3 p.m., a stationary engine meeting will be held at the society's headquarters, 28, Wanless Road, S.E.24. Members who have stationary engines of any kind should bring them along to this meeting. Facilities for testing pressure-gauges and the hydraulic testing of model boilers, etc., together with the provision of compressed air and steam will be available as required.

Visitors will be cordially welcomed, and application forms for membership may be obtained from the Secretary, MR. E. C. YALDEN, 31, Longdon Wood, Keston, Kent.

The Stephenson Memorial Miniature Locomotive Association

A meeting will be held at the Vane Tempest Hall, Durham, at 3.0 p.m. on Saturday October 2nd, 1954, to discuss matters arising from the first Locomotive Rally which was held at Roker Park, Sunderland, recently, together with other matters relevant to the running of small gauge locomotives.

J. W. CARTER, 28, East Avenue, Billingham, Co. Durham.

North London Society of Model Engineers

At the September general meeting, interest was taken in the forthcoming Exhibition to be held at Ewen Hall, Wood Street, Barnet, September 28th to October 2nd.

Mr. Baldock had his new bench drilling machine on view and gave a very interesting description of how he constructed it. This was followed by Mr. Weaver with his Sunbeam car, which he was building to be an exact copy of same at the time the prototype was driven at 150 miles per hour by Malcolm Campbell in 1924.

Mr. Brookes then produced his microscope, which was a very fine piece of work, following closely Mr. Sparey's. The meeting was held by courtesy of the Eastern Gas Board at their office in Station Road, New Barnett.

Hon. Secretary: W. W. RANSOM, 6, Arundel Court, 127, Woodhouse Road, N.12.

Grimsby and District Society of Model and Experimental Engineers

The above society will be holding their bi-annual exhibition in St. Aidans Church Hall from October 19th to 23rd, and have this year included two new classes, namely—ladies handicrafts and handicrafts by school-children, in addition to the usual classes for locomotives, traction engines, stationary engines, c.i. and i.c. engines, cars, ships, aircrafts and handicrafts. The mobile locomotive track will be in operation for rides, throughout the exhibition, and refreshments will be available during the afternoon and evenings.

Hon Secretary: H. C. EMMERSON, 30, Baytree Avenue, Grimsby, Lincs.

Eltham & District Locomotive Society

The next meeting will take place at the Beehive Hotel, Eltham, at 8.0 p.m. on Thursday, October 7th, 1954. This will be a very special night, as our chairman, Mr. Hutton, has promised, provided transport is available, to bring along his 3½-in. gauge "Princess" locomotive of which the society is very proud to announce was awarded a silver medal in the locomotive class, and the Dr. Bradbury Winter Cup for the best piece of work in the show at the "M.E." Exhibition.

This beautiful piece of craftsmanship is worth making a special effort to see, and Mr. Hutton will give a talk on its construction. Members are asked to make a very special effort to attend this session.

At the last meeting, Mr. Hereforth gave his talk for lathe work and went very thoroughly into the subject of lathe tools and their uses. He acquitted himself very well for his first talk to the society, and proved to be a very fluent speaker.

Visitors are always cordially invited to the meetings.

Hon. Secretary: F. H. BRADFORD, 19, South Park Crescent, S.E.6.

The Keighley & District Model Engineering Society

We are holding our second big exhibition on September 23rd to 25th, 1954, in the Temperance Hall Keighley, daily from 11.0 a.m. to 9.0 p.m. We are being assisted by all the clubs in the district, and we shall have on view the Racing Trophies of the Burwin Sailing Club, and a complete 12-ft. sailing dinghy which was made by one of our members and with which he had a grand holiday.

We have been fortunate enough to obtain some land for the laying down of a track. This may be sufficient incentive to keep a number of locomotives in production among our members.

We are fortunate in being in the centre of our friends of other societies who have offered many times the use of their locomotives in case we ever were in need. We hope that by the time the track gets under way that we shall have a number of locomotives in use from the different types at present being built. The winter programme is almost arranged and if club secretaries care to apply, we will supply full particulars of all meetings, etc., and give anyone who cares to call and see us the best of welcomes.

May we hope to see many of our friends at the exhibition.

The Secretary is: Mr. N. WALLER, c/o National Provincial Bank, North Street, Keighley, Yorks.

S.M.E.E. Affiliation—East Midlands Branch

The autumn delegate meeting will be held at the Training Centre, Stanton Ironworks, near Nottingham, at 3 p.m., on Saturday, September 25th. It is expected that those present will have the opportunity of touring the blast furnaces, and of watching "tapping" in progress. Delegates from any society (whether affiliated or not) will be made welcome, as we hope to discuss the effects of the recent joint affiliation-federations meeting held in London.

Further details may be obtained from the Branch Hon. Secretary: S. L. REDSHAW, 191, Harrowby Lane, Grantham.

At the recent Brighouse "Club Day," D. Lynch cleans out the firebox of "Dalesman," while J. H. Balleny of Birmingham enjoys a chat in the sun with Douglas Miller, president of the Brighouse S.M.E.E., and Mrs. Miller. (Photo by "Northerner")

THE MODEL ENGINEER DIARY

September 23rd, 24th and 25th.—Keighley and District Model Engineering Society.—Exhibition at the Temperance Hall, Keighley.

September 25th, 27th, 28th, 29th, 30th, October 1st and 2nd.—Southport Model and Engineering Club.—Exhibition in the Chapel Street Congregational Schoolroom.

September 28th, 29th, 30th, October 1st and 2nd—North London Society of Model Engineers.—Exhibition at Ewen Hall, Wood Street, Barnet.

October 2nd, 3rd, 4th.—Sutton Coldfield and North Birmingham Model Engineering Society.—Exhibition at the Church House, Eadington.

October 19th, 20th, 21st, 22nd and 23rd.—Grimsby & District Society of Model and Experimental Engineers.—Bi-annual exhibition at the St. Aidans Church Hall, Grimsby.

October 27th, 28th, 29th, 30th.—Trowbridge and District Society of Model Engineers.—Annual exhibition at St. James' Hall, Union St., Trowbridge. Open from 10 a.m. to 10 p.m. daily.

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WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone Euston 4661.

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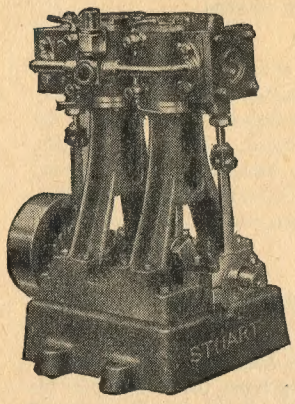

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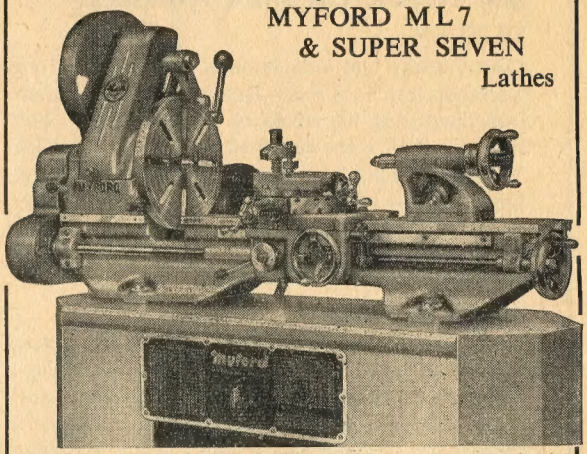

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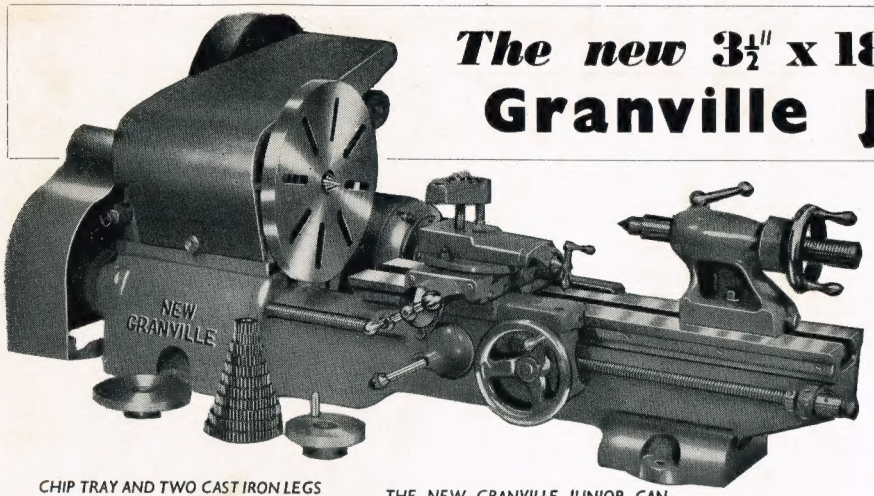

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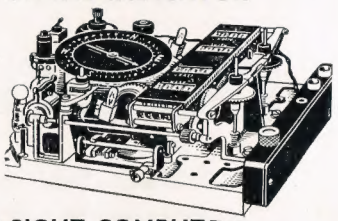

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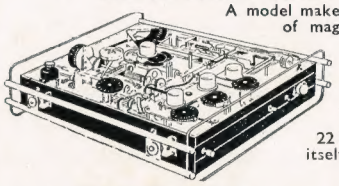

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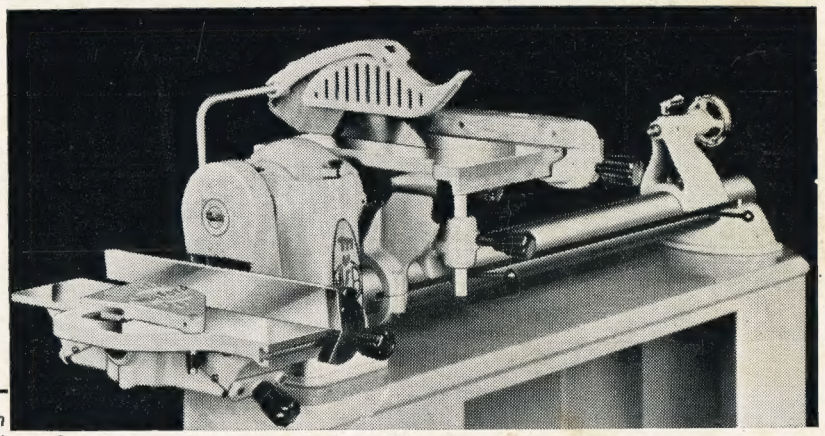

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